

GENERAL FISHERIES COUNCIL FOR THE MEDITERRANEAN
INTERNATIONAL COMMISSION FOR THE CONSERVATION
OF ATLANTIC TUNAS

Report of the

GFCM-ICCAT EXPERT CONSULTATION ON EVALUATION
OF STOCKS OF LARGE PELAGIC FISHES
IN THE MEDITERRANEAN AREA

Bari, Italy, 21-27 June 1990

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 1991

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PREPARATION OF THE PRESENT REPORT

The present text is the final version of the report approved by the Expert Consultation on the Evaluation of Stocks of Large Pelagic Fishes in the Mediterranean of the General Fisheries Council for the Mediterranean (GFCM) and the International Commission for the Conservation of Atlantic Tunas (ICCAT). It also contains those scientific and technical papers authorized by their authors, and the references are as submitted.

Distribution:

Participants

GFCM Mailing List

ICCAT

European Economic Community

FAO Fisheries Department

FAO Regional Fishery Officers

General Fisheries Council for the Mediterranean; International Commission for the Conservation of Atlantic Tunas.

Report of the GFCM-ICCAT Expert Consultation on Evaluation of Stocks of Large Pelagic Fishes in the Mediterranean Area. Bari, Italy, 21-27 June 1990.

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ABSTRACT

The experts gathered in Bari reviewed the data and analyses available for the tunas and swordfish in the Mediterranean particularly bluefin tuna (Thunnus thynnus, L.), albacore (T. alalunga, Bonn.) and broadbill swordfish (Xiphias gladius, L.). The national fishery situation for Algeria, France, Greece, Italy, Japan, Libya, Morocco, Spain and Yugoslavia was also reviewed. The Consultation dealt particularly with catch and effort data, including their distribution, individual fish size, and a few data from tagging and recapture of tagged fish, hence migrations. The Consultation recommended the implementation of an international programme of fish-marking by tetracycline, with a view to improving estimates of age, hence fish growth, accompanied by age-reading from hard parts such as otoliths, scales and fin spines. The experts then compared the various estimations of the length-weight relationship, growth and mortality, taking into account possible differences between males and females, on the one hand, and between the Atlantic and Mediterranean fish, on the other, with particular interest centering on the rate of mixing between fish of the two seas. Finally, the experts evaluated the stock including possible effects of the deployment of large-scale pelagic drift-nets in the Mediterranean. Although the data did not permit complete satisfaction with respect to the main species, the experts were satisfied with the progress made during this Consultation. The shortcomings of certain data series were identified, this allowing the Consultation to indicate to ICCAT and GFCM members where further studies are needed. The Consultation recommended the organization of a second such meeting of this kind in the near future. Some twenty-five scientific or technical contributions were presented during the Consultation, of which eighteen new ones are collected in an Annex hereto.

FOREWORD

This is the report of the General Fisheries Council for the Mediterranean (GFCM) - International Commission for the Conservation of Atlantic Tunas (ICCAT) Expert Consultation on the Evaluation of Stocks of Large Pelagic Fishes in the Mediterranean Area, held at the Hotel Sheraton in Bari, Italy, on June 21-27, 1990, at the invitation of the University of Bari.

At its Nineteenth Session (Livorno, Italy, February 27-March 3, 1989), the General Fisheries Council for the Mediterranean (GFCM), of the Food and Agriculture Organization of the United Nations requested some assistance from the International Commission for the Conservation of Atlantic Tunas (ICCAT), to carry out stock assessment of tunas and tuna-like fishes in the Mediterranean Sea. The ICCAT representative attending the Nineteenth Session as an observer informed the GFCM of the ICCAT scientists wish to fully collaborate in this type of work. Consequently, the Council suggested holding a joint meeting with the ICCAT.

Since ICCAT tuna evaluations have been hampered by the lack of fisheries data from ICCAT non-member countries in the Mediterranean area, ICCAT approved, at its 1989 Commission Meeting, hold a joint meeting.

The objective of the meeting was to carry out an assessment of the stocks of Large pelagic fishes (mostly bluefin tuna, swordfish and albacore) in the Mediterranean Sea, jointly by experts from ICCAT and from non-ICCAT member countries in the Mediterranean area.

The FAO Secretary for GFCM served as the General Secretary of the meeting while the ICCAT Secretariat provided the meeting with technical services such as data processing and running of analytical programmes.

This volume contains the Report which was adopted by the Group, and further edited by both Secretariats. For this reason, the style and editorial policy of both organizations were adopted. This volume also contains those scientific and technical papers presented at the Consultation (unless published elsewhere) which have been authorized by the authors for inclusion.

According to the agreement between GFCM and ICCAT Secretariats, the Report is published both as a FAO "Fisheries Report" (No. 449, in English) and an ICCAT "Collective Volume of Scientific Papers" (Vol. XXXIII, in English); the only differences lie in the first cover and prefacial pages). The present version is copyrighted by FAO.

Since some of the papers included in Appendix III are working documents, prior approval of the authors is requested, should anyone wish to use any of these papers for reference purposes; they are reproduced here in their original languages.

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*GENERAL FISHERIES COUNCIL FOR THE MEDITERRANEAN (GFCM)
INTERNATIONAL COMMISSION FOR THE CONSERVATION OF
ATLANTIC TUNAS (ICCAT)*

EXPERT CONSULTATION ON EVALUATION OF STOCKS OF
LARGE PELAGIC FISHES IN THE MEDITERRANEAN AREA

Bari, Italy, 21-27 June 1990

SUMMARY REPORT

I. OPENING

1. The Dean of the Faculty of Veterinary Medicine of the Università degli Studi di Bari, Prof. Giuseppe Marcotrigiano, opened the Consultation in the Aula Magna of the University. He stressed the importance to the city of Bari and the Regione di Puglia, inter alia, of the fisheries for tunas and swordfish in the Adriatic and Ionian Seas, and the work being carried out on these fishes in the Faculty.

2. Prof. di Benedictis welcomed the participants on behalf of the Rector of the University, Prof. Attilio Alto, who was unable to attend. Prof. di Benedictis also stressed the importance of studying the living marine resources of the Mediterranean in order to improve the food supply to the growing population of the region. In welcoming the participants, he noted the wide range of countries represented.

3. Representatives of other local authorities also welcomed the participants. The representative of the Ministero della Marina Mercantile, Admiral Gravina, expressed the Minister's regret that he could not attend and his best wishes for the success of the meeting.

4. The Consigliere della Pesca of the Regione Puglia and the representative of the Comune di Bari expressed their best wishes for the success of the meeting, and their interest in its outcome.

5. The Secretary of GFCM, on behalf of the Council, expressed his gratitude to the Università degli Studi, the Regione Puglia, l'Amministrazione Provinciale, the Ministero della Marina Mercantile, the City of Bari and the several financial institutions that had contributed to the support for the meeting, notably the Cassa di Risparmio and the Banca Popolare della Murgia. He also expressed his personal thanks to Prof. Gregorio De Metrio, of the Faculty of Veterinary Medicine, and to Miss Mary Lonigro, of the New Inter Centre (conference organizers) for the excellent local arrangements.

6. The Assistant Executive Secretary of ICCAT added his thanks to the local authorities and the host institution. He noted that this was the first joint meeting held by ICCAT and GFCM. The Mediterranean is part of the ICCAT convention area but only a few Mediterranean countries have actually joined ICCAT; this explains the main reason for joint action with GFCM. Although Mediterranean bluefin tuna are almost certainly, and other tunas and swordfish could be, part of the eastern Atlantic stocks, a significant part of these stocks breed and grow in the Mediterranean, and their evaluation is essential not only to the fishery in the Mediterranean but also to that in the Atlantic Ocean.

7. The Dean of the Faculty of Veterinary Medicine then invited the participants to a cocktail.

8. The List of Participants is given in Appendix II to this Report.

II. ELECTION OF CO-CHAIRMEN

9. Two co-chairmen were proposed to deal with different parts of the Agenda. The Consultation invited Prof. Gregorio De Metrio to take the chair for items 1 to 8 and 18, and Dr. Jose-Luis Cort, for items 9 to 17. Both accepted.

III. ADOPTION OF THE AGENDA

10. It was proposed that item 13.1 (Review of stock structure) of the Provisional Agenda become new item 9 (same title). Item 2 was also slightly changed (from Election of the Chairman to Election of the Co-Chairmen). The Consultation adopted the Agenda as amended; it is given in Appendix I to this Report.

IV. NOMINATION OF RAPPORTEURS

11. The Consultation decided to assign different subjects to various Rapporteurs. Mr. Ray C. Griffiths was invited to be the General Rapporteur and to coordinate the preparation of the Summary Report. Messrs. Peter Miyake, Stephen Turner, Jacek Majkowski, Michel Savini, Jaime Mejuto, and Nobuyuki Miyabe were invited to take part in drafting the report for the various agenda items. All accepted these tasks.

V. REVIEW OF WORKING PAPERS

12. The papers that experts wished to present were reviewed briefly and it was agreed that they should be discussed under the appropriate agenda items. All the papers presented, with the exception of those published elsewhere or those which the authors did not wish to be included, are given in Appendix III to this Report.

VI. REVIEW OF NATIONAL FISHERIES

13. Brief reviews were made of the Mediterranean fisheries for tunas and/or swordfish of several countries: Algeria, France, Greece, Italy, Japan, Libya, Morocco, Spain and Yugoslavia.

14. Mr. G. Kadari (Algeria) reported that tuna fishing is very limited in Algeria. Disparity of field results and the unreliable data obtained so far make it difficult to have a clear idea of this fishery. It is clear that, in spite of the fact that tuna migrate along the Algerian coast, Algeria does not take its share of this resource. However, since 1989, serious efforts are being made to improve knowledge of the dynamics of this resource: fishing gear has been acquired, experimental fishing has been undertaken and a programme of sampling and data collection has been initiated. A more detailed report is given in Appendix III to the present report.

15. Mr. B. Liorzou (France) reported that France has a Mediterranean commercial fishery for bluefin tuna and this species is mainly taken by purse seiners (26 in 1988) and occasionally by the rod-and-reel sport fishery. The total catches increased regularly up to 1985 to a level that has remained constant (about 5000 metric tons per year) in recent years. The fishing season begins in April and ends at the beginning of December. The maximum landings are in August, September and October. There have been two major changes in the purse seine fishery. The first is the use of a spotter aircraft since 1982. The second is in the fishing areas. The fishing effort in recent years has shifted from the east to the west of the western Mediterranean basin and a new fishery has been developed in the last three years around the Balears for big fish during the spawning season (June-July). Other species, such as albacore (*Thunnus alalunga*) and bonito (*Sarda sarda*), are present at a certain time of the year along the French Mediterranean coast, but the landings are not yet very important and, for albacore, the biggest problem is the low price offered to the fishermen for this species in the Mediterranean. A detailed report on the French bluefin tuna fishery is found in Liorzou (in press).

16. Mr. S. Tselas (Greece) reported that the fishery for large scombroids is a relatively new activity in Greece. There are 530 vessels involved, with a total annual catch of 2400 metric tons. Swordfish is the most important of all the large scombroids exploited in Greece, with 360 boats operating from 70 ports, in 1989. Fishing for swordfish occurs throughout most of the Aegean Sea, off the west coast of Greece in the Ionian Sea, and occasionally in the Levant Sea towards Cyprus. The height of the fishing season for swordfish is from May to September. The closed season is from 1 October to 31 January. Only drifting longlines are used. In 1989, 1700 metric tons of swordfish were landed.

17. Only 55 vessels fish for bluefin, mainly in the northern Aegean Sea. The fishing season is from the end of August to the end of November. The gears used are pole-and-line, troll-line, encircling gillnets; two vessels use purse seines and another two use Japanese longlines. In 1989, 170 metric tons of bluefin were taken.

18. One hundred and seventy vessels fish for albacore, mainly in the Khalkidiki and Sporades regions. The fishing season is from 15 August to the end of November. The gears are longline and troll-line. The albacore catch was 500 metric tons in 1989. A somewhat more detailed account is given in Appendix III to the present report.

19. Mr. A. Di Natale (Italy) reported that the bluefin tuna fishery is of some importance in Italy, although there has been a decrease in catches during the past five years. Purse seine catches decreased by 89 percent in 1984-1988; the Tyrrhenian fleet has decreased 62 percent. The remaining tuna traps catch around 300 metric tons per year regularly. In contrast, a big increase in catches is reported for the sport fishery and the line fishery, although the total quantity is still low. The harpoon fishery is of marginal importance and is carried out by a traditional fleet of about 20 boats in the Strait of Messina. Longline and line fisheries for juvenile tuna are still carried out off southern Italy.

20. The fishery for albacore catches 3400 metric tons by longlines, surface driftnets (with a medium mesh size of 12-18 cm) and lines (with a pole-and-line method with chumming). Different mean lengths reported for the Ionian Sea and the Tyrrhenian Sea may be caused by the different seasons in which fishing is carried out.

21. The Italian large-pelagic fleet catches more than 10000 metric tons of swordfish and the length-frequency of the fish covers rather a large length range. The fleet uses mostly driftnets (in spring and summer) and drifting longlines (all year round). A traditional harpoon fishery for swordfish is still carried out in the Strait of Messina, but the catches are decreasing, due to the reduction of the fleet. Two detailed reports on tuna and on swordfish fisheries in the southern Tyrrhenian Sea are given in Appendix III.

22. Mr. N. Miyabe (Japan) reported that the only Japanese fishery currently operating in the Mediterranean is the longline fishery, mainly for adult bluefin tuna, with a very minor by-catch of swordfish. The catch has decreased in recent years, to less than 300 metric tons in 1988. The fishing season starts in March in the waters around the Strait of Gibraltar. The fleet enters the Mediterranean in April and May, apparently following the fish which migrate into the Mediterranean to spawn. During this period, operations are observed as far east as 20° E. Since 1975, fishing in the Mediterranean has been prohibited between May 21 and June 30, because of Japanese domestic regulations aimed at the protection of spawning adult fish. The fleet moves to the Atlantic, due to this regulation. Since 1985, another regulation has been in effect that limits to 35 the number of boats allowed to operate in the Mediterranean. A detailed description of the Japanese Mediterranean longline fishery is given in Appendix III to the present report.

23. Mr. N. El Kebir (Libya) reported that two of the six Libyan traps constructed along the Libyan coast are used for catching large pelagic fishes. The fishing season for that fishery is February to June or July. The bluefin tunas caught by trap are in the length range of about 60 to nearly 300 cm.

24. The only other tuna fishing operation off Libya this year has been from a Korean joint venture longline vessel. This vessel also targeted bluefin tuna, with a catch of about 50 individuals, including swordfish, this year. The hooks are set at 100 to 300 m. The total bluefin catch reported by FAO were considered unreliable by the Consultation, due to inaccuracies in the species composition of the Libyan catches.

25. Mr. A. Srour (Morocco) reported that tunas migrate from the Atlantic into the Mediterranean mainly in April-June and emigrate in September-November. Although the Moroccan catches represent only a small percentage of the total national catches, the peak fishing seasons correspond to these two migrations. The principal tuna species are bluefin tuna, swordfish, bonito and frigate tuna. Four fishing methods are used: purse seines, longlines, traps and artisanal methods (pole and line, gillnets, etc.). However, the use of longlines to catch tunas has virtually disappeared in the last two years. The principal fishing area is in the vicinity of the Strait of Gibraltar and between El Hoceima and Saidia. The catches of tunas and related species from the Mediterranean were 1133 and 1605 metric tons for 1988 and 1989, respectively. A detailed report on the Moroccan tuna fishery in the Mediterranean is given in Appendix III of the present report.

26. Mr. J. Mejuto (Spain) reported that some 145 longliners fish for swordfish. The average annual catch for the last ten years is 1100 metric tons (average fish weight was nearly 26 kg). The Spanish swordfish fishery covers the whole of the western Mediterranean to 42°N, 8°E. Fishing is carried out all year round, with peak effort in summer and autumn. A few metric tons are taken by drifting gillnets near the Strait of Gibraltar between May and August. Bluefin tuna are taken by various gears. The catches in 1984, 1986 and 1989 were 2711, 559 and 1321 metric tons, respectively. The average annual catch for the Mediterranean in the last six years has been 1300 metric tons. Three traps operating in the vicinity of the Strait of Gibraltar capture about 200 metric tons a year (mean fish size: 150 kg). The fishing season for these traps is from July to October. Surface longlines catch about 100 metric tons of bluefin per year. Although longlines are used all year round, the bluefin catches are greatest in May and June. Age classes II-XV predominate in the catch. An average annual catch of 250 metric tons of bluefin is taken by the pole-and-line fishery in two quite different periods: April-June, and August. Fishing starts at Cape Gata and extends along the coast to Catalonia. Most of the individual fish are of year class V or older. Two purse seiners fish for bluefin off Catalonia, taking fish 20-100 kg in individual weight. When fishing for clupeids, young bluefin (age-class 0) may be taken in appreciable quantities in September-November. Occasional, or seasonal catches are also made by surface gears (driftnets, trolls, seines, etc.). The catches have varied between 219 and 717 metric tons over the last five years. A detailed report on Spanish Mediterranean tuna fisheries is given in Appendix III to the present report.

27. Ms. V. Alegría Hernández (Yugoslavia) reported that Yugoslavian tuna fishing by traps and fixed nets dates back to the sixteenth century. The first purse seiner was introduced in 1929. From 1947 to 1964 traditional gears were used. From 1965 on, only purse seiners were used to catch tunas as well as small pelagic fishes. Thirty-two boats operated in 1958, but the number of vessels dropped to about 14 as tuna catch rates in the Adriatic region were low. Most of the purse-seining is done at night (by detection of phosphorescence produced by tuna movements). Between 1947 and 1964, the total bluefin catch dropped from 897 (1947) to 271 metric tons (1964); thereafter and until 1974, catches were variable and low, at about 220 metric tons. From 1978 to 1988, the catch increased to a maximum of 1523 metric tons (1988), with a mean of 822 metric tons. However, the catch in 1989 was only 560 metric tons. The data on catches of small tuna species are less reliable, but show a decreasing trend. Catches of bonito have been low in recent years, but a sudden increase was recorded in 1989. Small amounts

of frigate tuna, little tunny and skipjack may be taken. Tuna fishing is seasonal, being much less in winter. Individual bluefin weights range from 6 to 200 kg, though smaller specimens may be taken. However, bluefin weighing 6 to 14 kg predominate (52 percent). The main fishing areas are: northeast Adriatic, Kvarner and Kvarneric, Blitvonica and around the islands of Jabuka, Vis, Palagruza, Losinj and Dugiotok. A full report is given in Appendix III to the present report.

28. The Consultation welcomed these national reports as a basis for the discussion under specific agenda items.

VII. REVIEW OF THE DATA BASE

29. Before discussing the individual agenda sub-items, Mr. Peter Miyake briefly summarized the methodology of virtual population analysis (VPA) which has been applied to the stock assessment of bluefin tuna and swordfish by ICCAT scientists. From this standpoint, he explained the type of data required to create a data base for the stock assessment.

30. The Creation of a data base starts by collecting the most basic data; i.e., the total nominal catch by country and gear. These total catches must be broken down into size categories (i.e. catch at size). Therefore, in principle, all the catches should be sampled and size frequencies must be obtained. However, many fisheries are not sampled. Hence, size frequencies obtained from other fisheries have to be substituted.

31. Once the catches are sized (either applying the actual samples from that catch or from the substituted size data) the catch at length will be transformed into the catch at age and tuned to series of catch-per-unit-of-effort data, which can be considered as an index to the relative abundance of the stock. If we assume that catchability and natural mortality do not change over time, then the fishing mortalities applied for each age group in each year and the population number by age can be back-calculated for previous years.

32. Therefore, total catch, size of fish in the catch and stock abundance indices (CPUE) are the essential basic statistics needed for a VPA type of analysis. With this information in mind, the Consultation considered the data availability and quality for the Mediterranean large pelagic fishes.

A. Total national annual catches by gear

33. The ICCAT Secretariat provided a listing of basic nominal catch data reported by country, gear and year for all tunas and tuna-like species in the Mediterranean Sea, for the period 1950-1988. The Consultation reviewed the table and updated the base as far as possible.

34. Greek bluefin catches reported prior to 1985 were questioned, since the Greek bluefin tuna fishery started in 1985. It was clarified that these catches are a mixture of several tuna species and that frigate tuna appears to be the dominant species.

35. It was pointed out that the Italian purse seine catches of bluefin tuna from the Adriatic Sea have been reported for only 1985 and 1986, even though the fishery has been known to exist in this area in most years since the early 1970's. In the ICCAT data base, catch estimates were recorded for most years, but not for 1980-1984. The Consultation estimated that roughly 1000 metric tons had been caught in each of these years.

36. For the first time, Italian rod and reel catches of bluefin tuna from the Adriatic Sea were reported. The estimates for 1984 and 1985 were 10 and 50 metric tons, respectively. The Consultation agreed that 50 metric tons would be used for subsequent catches until better estimates become available. Italy also reported a catch of 10 metric tons by hand line in the Adriatic Sea for both 1984 and 1985. This fishery also started recently and is still developing. The Consultation agreed to carry 10 metric tons over to all the following years.

37. Tunisia has been traditionally a trap fishing country as far as bluefin tuna is concerned. However, the purse seine fishery has been developing since 1986 in its coastal waters, but the catch has not been reported. The total catch for 1988 was estimated as 100 metric tons by FAO.

38. It was reported that 95 metric tons (gilled and gutted) of bluefin tuna caught by purse seine were imported to Japan from Tunisia in 1988, corresponding to 120 metric tons round weight (Miyabe and Warashina, Appendix III). The Consultation recommended that the 120 metric tons of purse seine catch be added to 1988 and that the Tunisian trap catch should be estimated at 83 metric tons (the previous year's catch).

39. The Consultation recognized that the statistics for Italian swordfish have improved since 1985, when the new national research program on large pelagic fish started, although a majority of the catches are still reported in the mixed gear categories (a part of the longline and all of the driftnet, harpoon, handline catches, etc.). The catches for the period before 1985 were much under-estimated. The Consultation discussed in depth the possibility of separating the recent catches by gear, as the catch by different gears represent different sizes of fish.

40. The Consultation recommended that, in the future, the Italian swordfish catches by mixed gears be reported by gear, and that size samples be taken from each catch of the different gears.

41. The only new information on albacore catches concerned Greek landings. Although in the catch data base some albacore catches had been reported for past years, the Consultation concluded that there were no albacore fisheries for 1982-1985. The 1986 catch was estimated from surveys and reported as 486 metric tons and the catches in 1987-1988 were estimated to be on the order of 500 metric tons. The catches previously reported as albacore for those years were assumed to have been Auxis.

42. The basic catch data were updated and are attached as Appendix Table A to this report.

B. Catch and effort

43. The experts examined available catch and effort data, keeping in mind the possibility of using these data for indexing the stock abundance. The ICCAT data base contains the following catch and effort data by area and time strata:

Bluefin tuna

- Tunisian trap catch per trap-day for 1976-79
- Yugoslavian catch per boat for 1950-77
- Spanish Mediterranean trap catch per trap-day for 1987-1988
- Spanish handline catch per day of fishing for 1985-1988
- Spanish driftnet catch per day of fishing for 1984-1986
- French purse seine catch per day with catch for 1981-1988
- Italian Tyrrhenian purse seine catch per day for 1972-1987
- Japanese longline catch per hook for 1972-1987
- Spanish Atlantic trap catch per trap since 1950 (which is assumed to be an index of the abundance of large bluefin tuna entering the Mediterranean Sea for spawning)

Swordfish

Spanish longline catch per hook for 1975-1988

Albacore

Spanish baitboat catch per day of fishing for 1982-1985 (fishing discontinued since then).

44. Besides the data mentioned above, several catch-per-unit-effort data were reported at this Consultation. Arena (1988) calculated time series of catch per unit effort for bluefin tuna caught in the Tyrrhenian Sea by purse seine. The other data are only for a short period and are listed in Table 1. These values represent nominal catches per nominal effort and were available only as averages for the area and time period listed in the Table. Therefore, it would be difficult to standardize the indices.

45. The Consultation recommended that detailed original data be sent to the ICCAT Secretariat and entered into its data base, so that standardization could be made in the future, when the data are accumulated for a longer time period.

C. Distribution of catch and effort

46. Most of the catch-and-effort data in the ICCAT data base are by area (1° x 1° area) and time (month). The new data listed in Table 1 are mostly yearly averages for relatively small areas. However, raw data would be most useful for developing indices of abundance.

47. Geographical and temporal changes in CPUE distribution are often indicative of fish migration and/or stock structure. Data reported by small area and time strata can be used to investigate these biological characteristics and to develop indices of abundance which account for fish movement.

D. Size data

Bluefin tuna

48. In Miyake (Appendix III) size data contained in the ICCAT base are listed and the availability of size data for the reported catches are examined. It was explained that at past bluefin stock assessment sessions, ICCAT matched all the catches with existing size data. For the bluefin catches without matching size data, size samples from other fisheries or from the same fishery but from different years were used for the substitutions. After matching the catches with size data (or substituted size data), a catch-at-size file was created for the east Atlantic and Mediterranean Sea, for the period 1970 through 1988. (Miyake, Appendix III.)

49. The Consultation considered whether any additional size data had become available at this session. New data are as follows:

- Greek size frequencies from landings at Kavala Port for 1986 and 1987 (FAO Fisheries Report 412)
- Italian size frequencies from Tyrrhenian Sea catches by purse seine for 1982, 1984-1988 (Arena (a), Appendix III)
- Italian size frequencies from catches of mixed gears (excluding purse seine) in the south Tyrrhenian Sea for 1985 through 1989. (Di Natale (a), Appendix III)
- Italian weight frequencies of rod-and-reel catches from the Adriatic Sea for 1985 (C. Piccinetti, Italian Administ. Merc. Marine. 1988)
- Italian weight frequencies from purse seine catches from the Adriatic Sea for 1984 and 1985 (C. Piccinetti, Italian Administ. Merc. Marine. 1988).
- Yugoslavian weight records for small fish sold in fresh-fish markets, 1978, 1979, and 1981 through 1988.
- Tunisian weight frequencies of bluefin caught by purse seine and exported to Japan, 1988. (Miyabe and Warashina, Appendix III)

50. Then the Consultation examined all the past size-data substitutions made by the ICCAT scientists.

Italian North Adriatic Catches

51. Weight frequencies from purse seine catches for 1984 and 1985 were made available as listed above. The Consultation decided that the catches for these years should be sized with these new frequencies. For the other years, the use of French Mediterranean purse seine size frequencies was recommended but disregarding the fish over 100 cm. The Consultation believed that it would not be possible to perform all the necessary operations to resize the 1984-1985 catches before the end of the meeting, and decided (a) to use the file already prepared using French data substitutions and (b) to have the changes as suggested by the Consultation made before the next ICCAT meeting.

52. For the Adriatic Sea, Italy reported, for the first time, 10 and 50 metric tons of catches by rod-and-reel, for 1984 and 1985, respectively. These are in addition to the catches reported for the Tyrrhenian and Ligurian Seas. This fishery started only in recent years and is still developing. It was agreed that the 50 metric tons reported for 1985 be maintained as estimates for the following years until better statistics become available. For 1985, a weight frequency is available. For other years, however, no size data were available and it was agreed that the Spanish hand-line sizes be used for substitution. Once again, because of time constraints, it was decided that even the 1985 catch would be sized with Spanish hand-line size data for this Consultation only.

53. No size data were available for the Italian Adriatic handline fishery and it was agreed that the Spanish hand-line size would be used for the substitutions.

Yugoslavian Adriatic Catches

54. In the past, all the Yugoslavian Adriatic bluefin catches (by purse seine) have been sized by French Mediterranean purse seine sizes, but disregarding fish over 100 cm. In general, this procedure was approved. However, after a very careful review of the data presented by a Yugoslavian expert, it was concluded that all the bluefin of less than 10 kg caught by purse seine were sold at the fresh-fish market and weight frequencies of all the fish of that category were recorded for 1978 through 1988 (except for 1980). Therefore, these weight frequencies should be used for fish less than 10 kg in future studies. During this session, however, the data base already matched with the French purse seine size data was accepted.

55. From these weight frequencies, the total catch of fish less than 10 kg could be estimated. The difference between total reported catch and the estimate of fish less than 10 kg corresponds to fish over 10 kg which should be sized with the French purse seine fish over 10 kg.

56. It was understood that the fish between 10 and 40 kg are unloaded either at fresh-fish markets or at fish processing plants, while all the fish larger than 40 kg are unloaded at the plants. Fish between 10 and 40 kg unloaded at the market are sampled but no records have been extracted for the fish landed at these plants.

57. The Consultation recommended that the landing records (weight of fish) for those fish be examined and compiled to make a complete estimate of fish size in the catch.

Tunisian Catch for 1988

58. The Consultation recommended to size the 120 metric tons of the Tunisian purse seine catch in 1988 with the French purse seine size samples and to size the 1988 Tunisian trap catch with Spanish Atlantic trap samples.

Swordfish

59. The ICCAT Secretariat presented a catalogue of size data available and explained that the catch-at-size base was created only for the North Atlantic and not for the Mediterranean Sea, not because the Mediterranean stock was considered to be separate but because of the lack of size data for the majority of the Mediterranean fisheries.

60. For this Consultation, the ICCAT Secretariat created a catch-at-length file for swordfish of the Mediterranean Sea, adopting many data substitutions. The procedure used is reported in the paper by Miyake (Appendix III). The Greek swordfish catch at size for 1986 and 1987, as estimated by Megalofonou, De Metrio and Lenti (Appendix III), was included in this file.

61. Firstly, it was recognized that the Italian catch data have been significantly underestimated for the period prior to 1985. The Consultation felt that it would be impossible to carry out a stock assessment on the present data set for this earlier period. It was agreed that catch at size be created only for the period since 1985. It was also recommended that every effort be made to make better estimates of the level of catches for the pre-1985 period. This is particularly essential, should the Mediterranean catches be considered as part of the North Atlantic stocks.

62. Recognizing that many new swordfish size data have been submitted to this Consultation, each fishery was reviewed by the experts for availability of size data (particularly since 1985). In the absence of size data, possible substitutions were discussed.

Italian Fisheries

63. New size frequencies were presented for mixed-gear catches from the south Tyrrhenian Sea, 1985 through 1989 (see paper by Di Natale (b) in Appendix III). It was clarified that the Italian catches by unclassified gears, discussed in paragraph 36, were made by longline, driftnet, harpoon and hand lines. A major part of the mixed-gear catches came from the south Tyrrhenian Sea and was sampled. However, the rest of the catch was from other parts of the Tyrrhenian or Ligurian Seas and was not sampled.

64. It was pointed out that the size of the fish in the catch is dependent on the gears used and is often different for different gears. It was agreed that catches be reported separately for sampled and unsampled portions and that the southern Tyrrhenian unclassified gear size should be matched only to the corresponding catch data (i.e., from the south Tyrrhenian Sea). Since other catches could have different size compositions, the Consultation recommended that they also be sampled in the future. However, until better size data become available, the size data taken from the south Tyrrhenian catches can substitute for these unclassified gear catches from other areas.

65. Ionian and south Adriatic fisheries have been well sampled for 1985 through 1988 and monthly data became available. The Consultation decided to use these data for that segment of the catches.

66. Italian longline catches are mostly from the Ionian Sea. Therefore, those identified positively as longline catches are best sized with the Ionian Sea samples.

Greek Fisheries

67. Although there were Greek size data for 1988, they were not used for the catch at length. It was recommended that the scientists concerned create the catch-at-length file with the size data and send it to the ICCAT Secretariat in time for the coming swordfish stock assessment session or that the scientists provide the basic catch and size data by small time-area strata to the ICCAT Secretariat very soon.

Other Changes

68. Algerian and Tunisian catches have no corresponding size data. Fishing occurs relatively close to the shore. The Spanish longline fishery is widespread in the western Mediterranean and has operated for an extended period. Spanish longliners also fish in the waters near Algeria and Tunisia. For these reasons, it was agreed to use size data from the Spanish longline fishery for these catches.

69. Cypriot catches were reviewed and it was considered that Greek longline fishing in offshore waters may go as far afield as the fishing grounds of Cyprus. For this reason, it was recommended that Cypriot catches be sized with the Greek Aegean Sea samples.

70. It was agreed that the Maltese swordfish catches be sized with Italian Ionian longline size samples, since the fishery is only conducted in the summer time and Italian longliners are fishing near this area.

71. Turkish catches for 1985 should be sized with Greek size data for 1986 rather than with Spanish longline data for 1985.

72. With these changes, the Consultation approved the substitutions proposed by the ICCAT Secretariat (Table 2 of Miyake's paper in Appendix III).

Albacore

73. Spanish size data are available in the ICCAT data base. Greek catches for 1986, 1987 and 1989 have been sampled. Italian Ionian and Adriatic Seas catches were also sampled for 1986, 1987 and 1988. Those two series of samples showed very similar size frequencies. On the other hand, the 1985-1989 albacore size (Di Natale (a), Appendix III) from the south Tyrrhenian Sea showed very different size frequencies.

74. The Consultation noted that the size of albacore caught by the Spanish fishery is very similar to that from Greek and Italian Ionian fisheries. It was agreed that all the catches in the western Mediterranean should be substituted by Spanish longline size

samples and those from the eastern Mediterranean should be substituted by the Italian Ionian and Adriatic size data.

General comments

75. The Consultation noted and appreciated the great progress made by the Italian scientists in the collection of data and research on large pelagic fishes since 1985. It was recommended that research results from the north Adriatic Sea also be made available as soon as possible.

76. The Consultation also noted that the 1986-1987 joint research program on large pelagic fishes in the eastern Mediterranean Sea, funded by the European Community, has resulted in a great improvement in the data base and research activities.

77. The Consultation concluded that re-creating the swordfish catch-at-size base or creating a new albacore catch-at-size file would be very time-consuming, since many additional data were presented at this time. Therefore, the Consultation requested that the individual national scientists (including non-ICCAT countries) either send the basic data to the ICCAT Secretariat, who will put them all together as agreed, or that the scientists create national catch-at-size files and send them the ICCAT Secretariat. The results will be sent to the pertinent GFCM and ICCAT member countries for review and study.

78. On the other hand, the Consultation recognized that the modifications proposed for the current bluefin catch at length are relatively few and most of these corrections might be done during this session.

E. Tag release and recapture data

79. The tagging files in the ICCAT data base contain release and recovery information only for fish recovered in the Atlantic and Mediterranean Sea. Recoveries in the Mediterranean of tags released in the Atlantic have been very limited and are almost exclusively of bluefin tuna. A summary of the recoveries of bluefin tags in the north Atlantic and the Mediterranean Sea is given in Table 2. On-going tagging programs were reviewed and are listed in Table 3.

80. ICCAT has prepared posters in its three official languages (English, French and Spanish). These posters are available to any interested country or laboratory upon request. ICCAT annually requests information on releases made in the previous year and tag serial numbers used and/or in stock. The ICCAT Secretariat has some extra tags which could be provided for small-scale pilot tagging programs and it also can help countries in ordering the tags, should they decide to conduct large-scale tagging.

81. It was pointed out that many tags recovered by fishermen are not returned to the releasing agencies but are kept by them. The Consultation emphasized the importance of publicity to facilitate the recovery of recaptured tags. Since tagging is very costly to carry out, economizing on the recovery end is unjustified.

82. In this respect, discussion centered on the current amount paid as an incentive to return tags. The standard reward paid by ICCAT is \$4.00 per tag and many of the experts believed this is too little to be an effective incentive. The Spanish Institute of Oceanography has recently been offering \$50.00 and a tee-shirt as rewards for any recoveries of its tags. It seems that such a high reward draws more attention from the fishermen and that the recovery rate has thereby improved.

83. The \$4.00 rewards were adopted by the FAO Tagging Group as the international standard, and it was recommended that the standard prize be maintained so as to avoid any conflict as a result of paying different amounts, depending on the releasing agency, particularly where more than one type of tag recoveries might be reported.

84. Some attractive souvenirs (e.g., tee-shirts) might be more effective than a small amount of money. A suggestion was also made to give something practical for housewives as a reward. At any rate, the Consultation recognized the complications and difficulties in determining effective rewards.

85. Other important aspects include training clerks, fishery office personnel, and laboratory technicians working in ports who have the opportunity to receive tags from fishermen. Also, the importance of paying the reward on the spot upon receipt of the tag, and of having a feedback of information to the fishermen, were emphasized.

86. The Consultation recommended that every effort be made to recover recaptured tags from fishermen.

VIII. REVIEW OF BIOLOGICAL PARAMETERS

A. Length-weight relationships

Bluefin

87. No new information on bluefin length-weight relationships was presented. It was noted that the ICCAT SCRS uses separate equations for east Atlantic catches and Mediterranean catches (Table 4). The length-weight relationship of bluefin shows substantial seasonal variation and, for the west Atlantic, different equations are used for different periods in the year. Further investigations into the seasonal, geographic and size-related effects on the length-weight relationship were recommended for the east Atlantic and Mediterranean.

Swordfish

88. The Consultation examined seven length-weight equations reported for the Mediterranean and retained five for further analysis (see Table 4). The weight units were reviewed as well as the size, size range of the samples and the period of the year in which they were taken. The Consultation considered equation 2 as being the most suitable for developing catch-at-size data. Equations 3 and 4 were suspected of bias due to the possible use of individuals eviscerated according to different criteria. No differences by sex were found.

Albacore

89. The Consultation examined the length-weight relations provided for various sub-regions of the Mediterranean (Megalofonou; Arena *et al.*; and Arena (b); Appendix III, and Table 4). No differences by sex were found. The Consultation compared them with those from the Atlantic. These comparisons indicated that, for a given size class, the Atlantic specimens are heavier. The Consultation recommended that these differences be subjected to statistical analysis. Since there is a need for a length-weight equation for the Mediterranean, the Consultation recommended the provisional use of equation 7 in Table 4, since it is derived from a larger number of sampled fish even though it represents an area (Aegean Sea) where smaller catches are made. The Consultation recommended that comparisons be made of length-weight equations from all areas and months.

B. Growth

90. The Consultation noted that validated information is essential for reliably describing the growth of fish and observed that the strongest evidence on the change in size over time for large pelagic fish has come from tag recapture studies. It was encouraging for the participants to learn that there were indications that marks observed in hard parts might be validated for swordfish. The participants noted that Tsimenides and Tserpes (1989) presented information on the proportion of fish forming bands for different periods of the year which suggested that the bands might be formed only once a year. The Consultation noted that the Mediterranean Sea is one of the few areas in which swordfish are caught throughout most of the year and encouraged an international study to obtain samples for marginal-increment analyses.

91. The participants noted that Megalofonou and De Metrio (1989) had observed that the back-calculated length at age one and two from swordfish spines indicated a size which coincided with modes in length frequencies thought to be from a year class a year after being spawned. Megalofonou, Dean and De Metrio (Appendix III) reported that daily growth of small fish estimated using otolith indicated growth rates similar to those calculated from modal analysis of similar sized fish.

Bluefin

92. No new information on bluefin tuna growth was presented. The ICCAT SCRS uses the equation of Farrugio (1980) with an L_{∞} of 351.1 cm to assign age to fish at a given length. The size estimates from that equation are shown in Table 5.

Swordfish

93. Several growth curves were examined from papers presented at this meeting (paper by Cavallaro *et al.* in Appendix III of the present report) and previously published reports (ICCAT 1989; Berkeley and Houde 1983; Megalofonou and De Metrio 1989; Tsimenides and Tserpes 1989). The various parameter estimates are shown in Table 6 and several of the curves are plotted in Figure 1.

94. All the hard-part growth curves had large negative values of t_0 (Table 6) and, as a result, unrealistically high estimates of size at age 0. It was suggested that a growth equation with a different form from the von Bertalanffy might be more appropriate for swordfish. All the hard-part growth equations indicated that, at the larger numbers of bands, males were estimated to be smaller than females. It was noted that, at those larger number of bands, there were generally small numbers of fish sampled for one or both sexes.

Albacore

95. Papers by Megalofonou and by Arena *et al.* (Appendix III) were examined with information on the growth of albacore in the Mediterranean Sea. Both were based on the analysis of scales and are presented in Table 7. The results by Megalofonou (Appendix III) were reported to be preliminary, and it was stated that alternative tissues for aging were being examined. It was noted that the ICCAT SCRS (ICCAT 1990) studied several growth equations and selected for the North Atlantic a growth equation calculated by Bard and Compean-Jimenez (1980), which assumed that two rings were formed each year. This decision was based on that the estimates from the Bard equation were quite similar to estimates from a growth equation based on tagging data.

C. Natural mortality

96. No new information was presented to the Consultation. Although it was agreed that estimation of M is difficult, further investigations, such as the use of the possible relationship between k and M , are encouraged. Examination of the sensitivity of VPA results to uncertainty about M is recommended. The values of M used by the ICCAT SCRS follow.

Bluefin tuna

97. Natural mortality rates currently used by the ICCAT SCRS for the west Atlantic and the east Atlantic/Mediterranean stocks are 0.10 and 0.18, respectively. ICCAT scientists doubt that such different natural mortality rates exist for these stocks which are known to intermix, and they have recommended further research on the subject. The difference in opinion on the most appropriate natural mortality rate is, in part, due to differences in the assumed growth rates for fishes of the two regions.

Swordfish

98. For the North Atlantic swordfish a natural mortality of 0.2 is used by the ICCAT SCRS.

Albacore

99. The 1989 ICCAT Albacore Workshop recommended that a range of M of 0.25-0.35 be used initially for Atlantic albacore stock assessments.

D. Comparison of various measurements

100. The study of the relationship between fork length and pectoral-fork length was reported for large bluefin caught in the Greek fishery where fish are unloaded in dressed (headed) condition. The results of that study should be useful, when it is completed.

101. Fish are processed in a wide variety of ways and the associated terminology used to describe fish measurements varies. The Consultation considered this to be important, so descriptions of the condition of various large pelagic species on landing and the terms used to describe them are listed in Table 7. Considering these diversities in measurement currently applied, it is suggested that uniform methods of measuring fish and describing fish measurements be established by country and/or by fishery.

E. Sexual dimorphism

102. All three species exhibited differences in the proportions of male and females at length in the catches. For bluefin it was reported that males were more common in the catches of fish over 225 cm FL. Female *swordfish* were reported to be more common than males above 150 cm in the Atlantic and in the Mediterranean it was reported that, for fish over 150 cm FL, females predominated in the catches (De Metrio, 1987). For *albacore* in Aegean Sea catches, fish above 68 cm were dominated by males (Megalofonou, in Appendix III).

103. Differences in length-weight relationships of bluefin, swordfish or albacore have not been demonstrated over the sizes of fish sampled for either the Atlantic or the Mediterranean.

104. No differences in growth have been proven for bluefin in the Atlantic or Mediterranean. Studies of swordfish hard parts have consistently shown that females are larger than males with the same number of growth bands (see section 8.B and Figure 1). Sex-specific growth rates of albacore in the Mediterranean were not examined in the papers presented.

IX. REVIEW OF STOCK STRUCTURE

Bluefin

105. ICCAT has been working for many years under a hypothesis that there are two-stocks, one in the eastern Atlantic/Mediterranean and another in the western Atlantic, with limited intermixing. Mixing between eastern and western bluefin generally has been estimated from tag recoveries and hard-part micro-analysis to be less than 10 percent. However, for management purposes, SCRS considers Atlantic bluefin to be composed of an eastern (including Mediterranean) and a western stock.

106. The Mediterranean fish are considered as a part of the eastern stock. The Mediterranean Sea is the only known spawning ground for bluefin on the eastern side of the Atlantic; very clear migrations of ripe adult fish before spawning from the Atlantic to the Mediterranean can be seen in the trap and longline catches near Gibraltar; mass emigration of adult fish from the Mediterranean is also seen in the trap and longline catches after spawning; significant emigration of juveniles in the fall is detected by Spanish Mediterranean traps near Gibraltar; and there is a general lack of fish of 5 to 10 years old in the Mediterranean catch. Besides, there has been a considerable number of tags released in the North Atlantic and recovered in the Mediterranean Sea (Table 2).

107. The Consultation reaffirmed the observations and conclusions reached by the ICCAT scientists in past assessment sessions.

Swordfish

108. In the ICCAT stock assessment sessions, swordfish stocks in the North Atlantic have been considered as a single management unit, although the possibility of two stocks (eastern and western) with an unknown amount of mixing could not be rejected. In the 1989 stock-assessment session, because of conflicting information on the integrity of Atlantic swordfish stock structure, it was decided that analyses should also be conducted on eastern and western components as a second priority to an assessment of the overall North Atlantic stock.

109. ICCAT has not seriously discussed the relation between the swordfish in the Mediterranean and North Atlantic, because of the absence of biological information on interchange and because it has not been possible to create a data base for the Mediterranean due to the lack of good catch and size data.

110. The Consultation reviewed all the possible evidence concerning the stock structure of swordfish between these two areas. The growth curves estimated for both areas seem to show somewhat different patterns and the age of first maturity of the fish in the Mediterranean seems to be lower (105 cm for males and 135 cm for females) than those in the North Atlantic.

111. On the other hand, there is some evidence from the gillnet and trap fisheries near Gibraltar that potential spawners move into the Mediterranean in the springtime whereas spent adults move out of the area in summer. Also, fish with bite marks of *Isistius brasiliensis* (a species of shark found only in the tropical and sub-tropical waters of the Atlantic) are observed in the Mediterranean Sea.

112. Compared with the situation of bluefin tuna, there are some fundamental differences: i.e., swordfish are known to spawn in the tropical area of the Atlantic Ocean as well as in the Mediterranean Sea; the movement of adult fish through the Strait of Gibraltar does not appear to be as massive as is seen with the bluefin; there is no mass emigration of juveniles from the Mediterranean, and fish of all sizes are found in the Mediterranean.

113. From this knowledge, the Consultation considered that the swordfish in the Mediterranean Sea could be considered as a separate unit from the Atlantic stock(s), for the present stock assessment and management purposes, even though there is clear evidence of some inter-mixing of unknown amounts of fish between these two stocks.

114. However, the Consultation recommended that further investigation be made to understand genetic stock structure, and to estimate the rate of mixing between these two stocks.

Albacore

115. ICCAT scientists have been working under a two-stock hypothesis for the Atlantic; i.e., one in the North and another stock in the South. However, they have not yet given any serious consideration to the relationship between North Atlantic and Mediterranean fish.

116. The Consultation considered firstly whether the Mediterranean stock is independent of the Atlantic, and secondly whether there are any substocks in the Mediterranean Sea.

117. There are differences in morphological characteristics between Atlantic and Mediterranean fish, although they have not yet been tested statistically. It was reported that the Mediterranean fish definitely have a relatively larger head length to the fork length ratio than the Atlantic fish, and in the Mediterranean the pectoral fin is considerably shorter, not reaching as far back as the second dorsal fin.

118. The fish reach first maturity at 62 cm in the Mediterranean, whereas in the Atlantic the corresponding length is much higher. The estimated growth seems different and the water temperature at which fish of a certain size are taken also differs between the two areas. However, it was also hypothesized that some large fish found in the Tyrrhenian Sea might have come from the Atlantic, since such large fish are not normally found in the eastern Mediterranean Sea.

119. There has been one recovery in the Mediterranean Sea of a tag released in the Atlantic (Aloncle and Delaporte, 1976). There has been no albacore fishery near the southern coast of Spain in the Atlantic. Moreover, in the Strait of Gibraltar, albacore is seldom caught by either trap or gillnet.

120. The Consultation concluded that Mediterranean albacore can be treated as a separate stock from the Atlantic for stock-assessment and management purposes. The biological evidence available at present suggests an independent stock in the Mediterranean, but this needs to be confirmed by further research.

121. It was pointed out that the tagging projects presently being undertaken in the Mediterranean and the Atlantic would produce more information on the stock structure in the near future.

122. As for the stock structure within the Mediterranean, some studies have been made of morphometric characters, but it was suggested that all such information be gathered together and compared. In particular, the comparison of growth curves and

other biometric characteristics should not be made independently for areas but by comparing all the data from the different areas together in one analysis. Therefore, the Consultation recommended that the basic data be exchanged among the scientists working in the different areas and that they collaborate in the analysis of these data.

X. REVIEW OF CATCH-AT-SIZE DATA BASE

125. The bluefin catch data for the Mediterranean Sea were sized as agreed by the Consultation and re-created. As noted earlier, there was not sufficient time to make all of the recommended changes in matching catches with size samples, but these changes would be made in time for the next ICCAT meeting. The results were examined by country and gear and verified for correct substitution.

126. Due to time constraints, the catch-at-size data base was not created for other species at this time.

XI. AGING OF CATCH AT LENGTH

127. Mr. S. Turner explained the program to convert the catch-at-length into the catch-at-age table. The Farrugio (1980) equation, which the Consultation agreed to use for Mediterranean bluefin tuna, was applied and the birth date was assumed to be July 1. The equation was applied to the mid-point of the period covered by each frequency, and a corresponding age was assigned to that length class of fish.

128. The Consultation, having agreed with the ICCAT view that the east Atlantic and Mediterranean bluefin be treated as a single stock, used the entire catch at length from those areas to create the catch at age (Table 9). It was noted that the catch at age was not much different from that estimated by ICCAT in 1989. The catch at age for several nations and fisheries in the Mediterranean were tabulated (Appendix Table B) so that scientists could examine the information in detail, especially with respect to the accuracy of their decisions and prior decisions of other scientists concerning size composition substitutions.

129. The Mediterranean catch-at-age table was briefly reviewed by the experts and the following observations were made.

Spain

130. Data are missing for 1987 and 1988, whereas it is known that a few seiners have operated off the Catalan coast together with French and Italian seiners. The Consultation recommended that an investigation be made to estimate the catches and that the catches be matched with French purse seine size data.

Turkey

131. The 1986-1988 catches were sized by 1989 Turkish sampling at this time. However, this put most of the fish into the young age category, whereas the size of fish imported into Japan (Miyabe and Warashina, Appendix III) suggested that, for 1986-1987, the fish were larger. The Consultation recommended that substitution for 1986 and 1987 be changed to French purse seine size.

Greece

132. Use of the Kavala size frequencies, agreed upon earlier by the Consultation, was questioned, since the sample seems to include only large fish. Some smaller fish have been caught by fishermen from other areas and the Consultation was informed that a sample is available for small fish. It recommended that the catch be resized by Greek scientists using finer time-area strata and appropriate size samples and that the results be sent to ICCAT.

General

133. It was requested that all national scientists carefully review the catch-at-age table, and if some improvements have to be made, these modifications should be sent to the ICCAT Secretariat not later than 31 September 1990 for the coming stock assessment session. Such modifications must be done in terms of the number of fish by size.

XII. REVIEW OF ABUNDANCE INDICES SERIES

General

134. The Consultation defined abundance indices as time-series of values proportional to the abundance of the stock. Usually they refer to specific age-classes, though in principle, we can have indices reflecting the abundance of the entire stock. In the cases where they are indicative of the dynamics of the biomass of the entire stock or its specific age-classes, it is more appropriate to refer to them as biomass indices.

135. Such indices by themselves are of great interest to fishery scientists, managers, and fishermen, because they are indicative of the past dynamics of stocks and their responses to exploitation. However, it is difficult, if not impossible, to extrapolate the indices for age-classes and periods, including future periods (predictions) for which they are not available, although such an extrapolation is frequently required. Also, values of entire stock abundance and/or biomass are usually needed.

136. In order to obtain an estimate of the population size, a procedure called Virtual Population Analysis (VPA) is frequently used. Some versions of this procedure, which may be applicable to large pelagic fishes in the Mediterranean, require abundance indices as an input (see section XIV A). Consequently, abundance indices have an important twofold role, as valuable information in themselves on the state of stocks and as an input to relatively sophisticated stock-assessment analyses.

137. Time-series of the catch-per-unit-of-fishing-effort (CPUE) identified for northern bluefin tuna, swordfish and albacore (see section VII) were the only data available for the derivation of abundance indices. It was pointed out by some participants that, to satisfy the definition of abundance indices, the catches used need to be "aged". The aging of catches was considered under Agenda Item 11 and the procedure therefore was regarded as the only practical one for deriving abundance indices at this stage. To eliminate the potential problems with nominal fishing effort as a measure of effective fishing effort, the Consultation recommended that a general linear model (GLM) be used to standardize CPUE.

138. GLM is a commonly used procedure for many tuna stocks to obtain indices of abundance from CPUE. The purpose of GLM application is to eliminate differences in CPUE due to differences in seasons (usually months or quarters) geographical areas, fishing gear, environmental factors such as temperature, etc. This work needs to be done before VPA can be applied with confidence. Because of the limited time available, the standardization could not be performed, and the Consultation recommended that the required work be done during the period before the next meeting on stock assessment of Mediterranean large pelagic fisheries. As many Mediterranean fisheries directed at large pelagic species are multi-species, special attention should be paid to target and non-target species in standardizing indices.

139. Some participants pointed out that catch rate information from one area may be more indicative of the status of the stock than the catch rate from another area. The Consultation noted that it would be very difficult to determine beforehand whether one area was providing more useful information than another area. They further noted that GLM can be used to integrate catch rates from several areas and to compare the relative variability of catch rates from different areas. The Consultation once again recommended that basic catch and effort data from similar fisheries be exchanged among the scientists working in different areas and that they collaborate in the analysis of these data.

140. The Consultation recommended that attempts be made to derive indices of abundance from all the fisheries directed at the stocks of Mediterranean bluefin tuna, swordfish and albacore. This recommendation was made to cover the range of the age-classes, grounds, and seasons involved in the fisheries. That way, the Consultation hoped to get a better overall reflection of the dynamics of stocks. In view of the consideration of methods to be used for stock assessment (see section XIV A), the Consultation regarded such an overall reflection as very important.

Bluefin tuna

141. Table 10 gives ten abundance indices presented at the 1989 ICCAT SCRS meeting (ICCAT, 1990). From them, four were rejected at that meeting as providing little or no input information to the VPA that was used for the Mediterranean and eastern Atlantic stock. The rejected indices were from the French purse seine fishery in the Mediterranean for age class 1 for all years; age classes 2 and 3 for years prior to 1982, and from the Spanish baitboat fishery in the Bay of Biscay (eastern Atlantic) for age class 1. From the remaining indices, the participants pointed out that only the indices from the Japanese fisheries were standardized. There are definite plans to standardize soon the indices from the French fishery. Preliminary analyses suggest that standardization may have little effect on the Bay of Biscay index.

142. Mr. B. Liorzou reported on a series of CPUE for the French purse seine fishery in the Mediterranean off the south coast of France (including the Gulf of Lions). Before the World Meeting on Bluefin Tunas, which was held in La Jolla, California, in May 1990, these indices for age classes 2 and 3 did not account for days during which catches were not taken but fish were searched. The new indices were regarded as potentially valid for years for which spotter aircraft support (one plane) was at approximately the same level, i.e., since 1982 with the exception of a few years like 1984 when the plane did not operate. The two series of indices were not standardized, but they were very closely correlated and therefore, the use of the new series of CPUE may not have significant impact on the VPA results.

143. Mr. P. Arena briefly presented a paper (Arena (a), Appendix III). The CPUE provided by him (Table II of his paper) was neither "aged" nor standardized. It referred to a very wide range of age classes and showed a declining trend.

144. In response to questions from the participants, Mr. Arena provided supplementary information on the CPUE series from his document. In his calculations, fishing effort was expressed as the number of fishing days including the days during which fish were sought but not caught.

145. During the period for which the CPUE time-series was given, Mr. Arena showed that there was a change in the size of the vessels (from large to small) for economic reasons. He explained that the fishing power is independent of vessel size. He also mentioned that the support of spotter aircraft to the fishery stabilized in 1980.

146. Mr. Arena also indicated that it would be reasonable to develop indices of abundance for age groups from these data using the annual number of days fished and the numbers of fish caught at age for this fishery.

Swordfish and albacore tuna

146. Some participants pointed out that the available CPUE time-series, which are not "aged" and standardized, were short (5 years). Unless the abundance of the above-mentioned stocks changed very significantly during that period, the variability in the CPUE time-series, even after "aging" and standardization, is very likely to mask any trends.

XIII. DEPLOYMENT OF LARGE-SCALE PELAGIC DRIFTNETS

147. The GFCM Secretariat recalled that, in October, 1989, the Working Party on Marine Mammals, of the International Commission for the Scientific Exploration of the Mediterranean Sea (ICSEM), expressed concern about the impact of driftnetting on cetacean stocks and urged governments to increase research on this question. In November, 1989, at the annual meeting of ICCAT, a few countries commented on the use of driftnets in tuna fishing and it was recommended that the SCRS consider the effect of driftnet fisheries. In the same month, at its 25th Session, the FAO Conference recommended that FAO undertake scientific work to improve the information available.

148. Of particular importance was the resolution adopted by consensus by the General Assembly of the United Nations in December, 1989, on Large Scale Pelagic Driftnet Fishing and Its Impact on the Living Resources of the World's Oceans and Seas. This resolution recommended, inter alia, that all members of the international community, bearing in mind the special role of regional organizations in the conservation and management of living marine resources, agree to:

(i) moratoria on all large-scale pelagic driftnet fishing on the high seas by 30 June 1992 with the understanding that such a measure will not be imposed in a region, or if implemented can be lifted, should effective conservation and management measures be taken based upon statistically sound analysis, to be jointly made by concerned parties of the international community with an interest in the fishery resources of the region, to prevent unacceptable impacts of such fishing practices in that region and to ensure the conservation of the living resources of that region.

(ii) an immediate cessation to further expansion of large-scale pelagic driftnet fishing on the high seas, with the understanding that this measure will be reviewed subject to the conditions in para (i) above.

149. This resolution was brought to the attention of the GFCM Executive Committee at its 48th Session (February 1990) which agreed that the problem should be discussed by the present Expert Consultation. The Executive Committee recommended that the subject also be considered by the GFCM Committee on Fisheries Management, at its first session in 1991. This Committee should consider, inter alia, whether or not the moratoria recommended by the General Assembly should apply to the GFCM area and make appropriate recommendations to GFCM. The Executive Committee also instructed the Secretariat to seek extra-budgetary funds to conduct a detailed analysis of the problem to be submitted to the Committee on Fisheries Management. Informal contacts have already been made by the GFCM Secretariat with the EEC Commission, with a view to ascertaining its interests in a research programme for the Mediterranean.

150. The Consultation was also informed that the EEC Commission was studying the possibility of submitting to the Council of Ministers a proposal prohibiting the use of driftnets. It was noted, however, that the fisheries resources policy of the EEC does not apply to the Mediterranean.

151. The Consultation had before it the Report of the Expert Consultation on Large Scale Pelagic Driftnet Fishing, held in Rome (2-6 April 1990) and three papers dealing more specifically with the situation in the Mediterranean (Ferretti; di Natale; Troncone et al.; Appendix III).

152. It was first recalled that driftnets have been used in the Mediterranean at least since 177 B.C.

153. It was noted that, in the western Mediterranean, this type of gear was not very widely used. In Algeria a 3-km-long driftnet is now being used experimentally for fishing off the western coasts of the country. So far no interaction with marine mammals has been reported.

154. In Morocco, a fleet of 30-40 artisanal vessels is fishing seasonally for small tuna with driftnets of 3 to 4 km length. A scientific programme to follow up the activities of this fleet has just been established.

155. In Spain, about 50 small vessels use driftnets between 1.5 and 3.5 km length to take swordfish in the Gibraltar area. The observers placed on board these vessels by the "Instituto Español de Oceanografía" have not yet reported any incidental taking of marine mammals; so far, three turtles have been taken and released. In the Gulf of Lions, two French vessels are operating with driftnets of about 3 km in length.

156. Most of the large-scale driftnet fishing is taking place in the central Mediterranean and is conducted by Italian fishermen. The length of the nets used so far has varied, depending on the size of the vessels, from 2 to 40 km with an average of 12 km. The nets are made of multifilament polyamide fibre. Those targeting swordfish have a mesh opening of 400-450 mm and those fishing for albacore, a smaller mesh of 120-180 mm. The fleet consists of more than 700 vessels, the majority of them being below 15 m in length. Thirty-five vessels are about 25 m in length. The annual average catch is about 5000 metric tons of swordfish and 1000 metric tons of albacore. By-catch includes medium and large pelagic fishes, turtles, large cetaceans (e.g. sperm and beaked whales) and small cetaceans (striped and bottlenose dolphins). According to recent official statistics, about 100 marine mammals were taken in 1988. A systematic study is now being made with observers on board to obtain a more realistic assessment which would take into account the cases not officially reported by fishermen. This fishery provides direct employment to 5000 persons and indirect employment for another 20000 especially in the southern part of the country.

157. In 1989 and 1990, the Italian government has taken a series of measures aimed at freezing the number of licenses and at regulating the gear (minimum mesh size of 320 mm for swordfish, maximum depth of 35 m and maximum length of 2.8 km for coastal fishing and 9.3 km for offshore fishing, compulsory marking of nets) and the fishing season.

158. A few artisanal driftnetters (less than 10) are also reported to operate from Corsica.

159. Little information is available from the eastern Mediterranean. The Greek government is planning to prohibit the gear until the results of research currently undertaken are known. It appears that one vessel using a 10-km driftnet recently started to operate on the high seas in the Aegean Sea, and that 13 small units using nets of 3-km length are also operating in this sub-region.

160. Finally, it also appears that no driftnet fishing in the Mediterranean is being conducted by countries from outside the region.

161. On the basis of the available information and pending the outcome of the ongoing research programmes, the Consultation agreed that it was necessary to regulate strictly the use of driftnets in the Mediterranean, in particular through a limitation of the size of the net and through licensing schemes controlling the fishing effort, in the spirit of the Resolution of the UN General Assembly. It was also stressed that the consequences of global and indiscriminate moratoria on the use of driftnets in the Mediterranean should

be carefully studied. Besides painful socio-economic repercussions, the prohibition of large-scale driftnets might result in an increase in fishing effort for swordfish with longline. This would undoubtedly save a number of cetaceans but would also provoke the capture of several thousands of marine turtles (although many of these would survive if released by the fishermen) and of an increased number of juvenile swordfish (with unknown consequences on the swordfish stock).

XIV. STATE OF STOCKS

A. Stock-assessment models to be used

162. It was pointed out that models are necessary for extrapolation of fishing statistics. Such an extrapolation is possible only by the utilization of available biological information and the introduction of assumptions. Especially in the cases where such biological information is limited and the assumptions cannot be fully supported, the utilization of direct indicators from the fisheries for stock assessment is recommended. Such indicators may include gross catches, their size/age composition, CPUE and the indices of abundance.

163. The Consultation did not recommend, at this time, any specific models that could be used at present for the stock assessment for swordfish and albacore, in view of the relatively short time-series (five years) of catch and fishing effort statistics, limited tag-release/recapture data, no abundance indices independent of fisheries, and limited biological information. Although it was recognized that this meeting set a milestone in improving the Mediterranean statistics for large pelagic fishes, the Consultation emphasized the need to continue detailed data collection activities and to make every effort to obtain historical data.

164. At the meetings of the ICCAT SCRS, VPA has been used for the Mediterranean and the east Atlantic stocks. These applications were described in various ICCAT publications, including the SCRS Reports. The Consultation recommended further examination of the applicability and the application of VPA to these stocks. It was planned that this work should be carried out, in collaboration with GFCM scientists, in time for the stock assessment at the October/November 1990 SCRS meeting.

165. Participants in the Consultation recognized that there are uncertainties in many of the inputs to the VPA for northern bluefin tuna (see previous sections). In light of these uncertainties, sensitivity tests and simulation studies of VPA should be made.

166. In view of the early stage of stock assessment of several large pelagic fishes in the Mediterranean and the nature of information available on them, some participants felt that to limit stock assessment to VPA may not be the most efficient approach for building up the knowledge of the state of the stocks. Regardless of the likely suitability of the VPA, at least for east Atlantic/Mediterranean bluefin tuna stocks, the Consultation recognized that various approaches to stock assessment should be encouraged.

167. Megalofonou, De Metrio and Lenti (Appendix III) presented estimates of total mortality (Z) for Aegean Sea swordfish using the catch-curve methods of Beverton and

Holt (1957). Their estimates were 0.464 and 0.300 per year for 1986 and 1987 and 0.443 and 0.305 per year for the same years, respectively.

B. Application of models to the existing data

C. Review of results

168. These two items were discussed together. The Consultation was quite satisfied with the significant improvement made on the Mediterranean tuna and swordfish data base, since the lack of data for that region had prevented ICCAT from assessing these stocks or degrading the precision of the assessments. It also agreed upon the data substitutions for the catches for which size samples have not been made available. Therefore, it was recognized that the catch at length could now be created for swordfish and albacore, as well as greatly improving that now in existence for bluefin.

169. The Consultation, at the same time, discussed in depth all the parameters to be used in various models of stock assessments, and agreements were reached on the selection of many of these parameters.

170. The Consultation also reviewed the available catch and effort data and recommended use of GLM to develop standardized indices. Despite the fact that this was the first meeting of its kind for the Mediterranean Sea, and that three major species were studied, more than expected was achieved.

171. However, the time for the Consultation was limited and it was impossible to proceed further in applying stock-assessment models to the data base thus agreed upon, since the preparation of the data base, including all the changes, would take several weeks for three species. It is hoped that the coming ICCAT Swordfish Stock Assessment Session (September, 1990), Albacore Workshop (October, 1990) and the meeting of the bluefin species group (October-November, 1990) will follow up this work.

XV. RECOMMENDATIONS

172. The Consultation expressed its general satisfaction with the progress achieved. Nevertheless, considerable effort is needed for some of these species to improve further the data quality and estimates of biological parameters used in developing the assessments. It strongly recommended to GFCM and ICCAT that they consider carefully the convening of another Consultation on the same subject as the present one, in due course, as a valuable means of bringing together GFCM and ICCAT scientists to continue building a high-quality data base on the large pelagic fishes of interest.

173. The Consultation also recommended that the member countries of GFCM and ICCAT, and the concerned national institutions, be officially invited by each of these two bodies to promote actively the attendance of their experts at GFCM and ICCAT meetings at which the assessment of stocks of large pelagic fishes in the Atlantic Ocean and the Mediterranean Sea are planned, with the objective also of enhancing cooperation between the member countries of GFCM that are not members of ICCAT and member countries of ICCAT; that is, basically between Mediterranean and Atlantic scientists concerned with the fisheries for large pelagic fishes.

A. Statistics

174. Section VII of this report includes many recommendations made by the Consultation concerning statistics and sampling. During this session, an important quantity of new basic data became available and the Mediterranean data base has been improved to a great extent. The major reason for such an improvement was that many scientists working on large pelagic fishes met together for the first time. This allowed better communication among them.

175. All the recommendations made under Section VII should be well noted but, in addition, the Consultation recommended that:

a) close collaboration among the scientists working towards the same objectives be encouraged, such as exchange of basic data concerning biometric measurements, age, growth, etc.

b) the basic data on catch, detailed catch-and-effort and size be sent to the ICCAT Secretariat, which should serve as the data centre for the large pelagic fishes of the Mediterranean.

c) the ICCAT Secretariat provide the concerned scientists with a catalogue of the data base available at the Secretariat and provide them with a computer file upon request, insofar as the file is not confidential.

d) national scientists try to find historical data or make best estimates of missing past catches (e.g., Italian catches in the northern Adriatic Sea, Italian swordfish catches prior to 1985).

e) all the existing significant catches be registered separately by gear and sampled properly at least for fish size.

f) all the catches of small fish (age 0) reported in catch statistics be sized; this is particularly important for stock assessment of bluefin.

g) GFCM and ICCAT assist nations in developing adequate catch-at-size tables for the fisheries. GFCM and ICCAT give serious consideration to assisting Yugoslavia financially to extract size information for large bluefin recorded and accumulated at processing plants.

B. Research and technology

176. Regarding the development of research in support of the impact evaluation of each type of gear (e.g., environmental impact, interaction with other gears, catch composition, socio-economic factors, interaction with other human activities, etc.), the Consultation recommended that all Mediterranean countries promote, much more actively than hitherto, the necessary fishery and marine scientific research, with a view to developing reliable basic instruments for the management of the different stocks of large pelagic fishes.

C. Management

177. The Consultation learned that ICCAT has recommended some management measures for the east Atlantic and Mediterranean bluefin fishery:

That the Contracting Parties take the necessary measures to prohibit any taking and landing of bluefin tuna (*Thunnus thynnus*) weighing less than 6.4 kg.

Notwithstanding the above regulation, the Contracting Parties may grant tolerances to boats which have incidentally captured bluefin weighing less than 6.4 kg, on the condition that this incidental catch should not exceed 15 percent of the number of fish per landing of the total bluefin catch of said boats or its equivalent in percentage by weight.

That, as a preliminary step, the Contracting Parties that are actively fishing for bluefin tuna (*Thunnus thynnus*) or those that incidentally catch it in significant quantities shall take necessary measures to limit the fishing mortality of bluefin tuna to recent levels (ICCAT 1975).

178. It was noted that more severe size and catch regulations are in effect for the west Atlantic bluefin stocks.

179. The minimum-size regulation is based on yield-per-recruit studies and intended to increase overall yield by increasing the age at first capture. The implementation of this regulation would protect the majority of 1-year-old fish. However, this minimum-size regulation has not been effectively carried out even by ICCAT member countries in the Mediterranean areas. Table 11, which was prepared by the ICCAT SCRS, shows clearly that a very significant part of the catches, in number, in this area are of under-sized bluefin tuna. It was added that the age-0 fish catch is considerably underestimated in this Table, due to unreported catches of such fish.

180. Considering the seriousness of the problem, the Consultation recommended that at the next GFCM Session, the Council should decide whether or not the bluefin minimum-size regulation already recommended by ICCAT should also be the subject of a formal GFCM recommendation under Article 5 of the GFCM Agreement.

XVI. FUTURE RESEARCH AND WORK PLAN

181. The Consultation noted that a number of future studies had already been recommended under various Agenda items. The subjects covered are:

- a) improved estimates of Italian catches of swordfish prior to 1985;
- b) further investigations into genetic stock structure and estimation of the rate of mixing between Atlantic and Mediterranean stocks;
- c) completion of abundance indices, particularly by standardizing the catch and effort (by application of GLM on disaggregated data);
- d) statistical comparison of various biological parameters from different areas; and

- e) application of VPA for revised or newly created catch-at-age tables as well as some sensitivity studies of VPA for different parameters such as natural mortality.

182. However, the Consultation specifically proposed to GFCM and ICCAT that two important projects be carried out in the immediate future:

i) *Validation of age reading using hard parts*

It seems that the Mediterranean fishery offers an unique opportunity to validate age reading on hard parts, since size frequency and hard parts can be collected from the same sample, and since the fishery catches a wide range of fish sizes for extended fishing periods. The Consultation recommended that national scientists initiate or continue investigations on this subject, possibly in international collaboration.

ii) *International tagging with tetracycline injections*

Noting that there are three albacore-tagging cruises planned in the Mediterranean, and another in the eastern Atlantic, the Consultation called for international cooperation in the implementation of these tagging cruises. The essential component of such tagging would be the use of tetracycline injections, to verify aging. Injection into small swordfish is sometimes difficult but otherwise this method is easy to use and of little cost.

183. Different colored tags (generally red) are to be used to distinguish the fish injected with tetracycline so that fisherman can return the fish together with the tags. The ICCAT Secretariat offered to provide participants with some red tags on request. Special publicity for recovering tag and fish will also be required. Mr. S. Turner offered documentation on some special equipment used for easy injection of tetracycline.

XVII. ADOPTION OF THE REPORT

184. The Consultation reviewed the draft report and, after revision, adopted it. It was agreed that the ICCAT Secretariat would be responsible for making the final corrections as adopted, and circulate the report among the Rapporteurs for a final checking for accuracy. It will be published with an Appendix including all the scientific papers presented at the meeting, with the exception of those published elsewhere.

XVIII CLOSURE

185. At the closure of the meeting, the Consultation thanked the meeting host, Università degli Studi, the Regione Puglia and Mr. G. De Metrio for the excellent meeting facilities. The Consultation also appreciated the efficient meeting services provided by the New-Inter Centre, the support provided by the GFCM and ICCAT Secretariat staff, and the assistance provided by the interpreters between English and Italian.

186. The Chairman closed the Consultation at 19:10 on June 27, 1990.

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Table 1. Nominal annual average CPUE values made available, for the first time, during the session*

SPECIES	COUNTRY	GEAR	YEAR	AREA	PERIOD	E x 1000	CPUE kg	CPUE N.
HOOKS								
SWORDFISH	ITALY	LL	1984	IONIAN	JUNE-SEPT	849.6	92.2	2.0
SWORDFISH	ITALY	LL	1984	ADRIATIC	JUNE-SEPT	2085.0	40.2	1.3
SWORDFISH	ITALY	LL	1985	IONIAN	JUNE-SEPT	1554.9	52.1	2.0
SWORDFISH	ITALY	LL	1985	ADRIATIC	JUNE-SEPT	2070.0	58.0	2.6
SWORDFISH	ITALY	LL	1985	TYRRHENIAN	OCTO-NOVE		104.2	
SWORDFISH	ITALY	LL	1986	IONIAN	JUNE-SEPT	1019.0	58.9	2.2
SWORDFISH	ITALY	LL	1986	ADRIATIC	JUNE-SEPT	1570.5	50.2	1.5
SWORDFISH	ITALY	LL	1986	TYRRHENIAN	AUGU-DECE		56.5	
SWORDFISH	GREECE	LL	1986	AEGEAN south	JUNE-SEPT	122.5	142.5	6.2
SWORDFISH	GREECE	LL	1986	AEGEAN eastern	JUNE-SEPT	870.8	162.7	5.0
SWORDFISH	ITALY	LL	1987	IONIAN	JUNE-SEPT	743.6	71.9	2.8
SWORDFISH	ITALY	LL	1987	ADRIATIC	JUNE-SEPT	572.8	134.8	8.4
SWORDFISH	GREECE	LL	1987	AEGEAN south	JUNE-SEPT	156.9	114.5	6.4
SWORDFISH	GREECE	LL	1987	AEGEAN eastern	JUNE-SEPT	2300.1	94.6	2.7
SWORDFISH	ITALY	LL	1988	IONIAN	JUNE-SEPT	316.9	66.6	3.9
SWORDFISH	GREECE	LL	1988	AEGEAN south	JUNE-SEPT		90.5	4.9
100 m net								
SWORDFISH	ITALY	GILL	1985	TYRRHENIAN	APR-SEPT	1.04		
SWORDFISH	ITALY	GILL	1986	TYRRHENIAN	APR-AUG	0.90		
CPUE kg x fishing day								
SWORDFISH	ITALY	HARP	1985	TYRRHENIAN	APR-AUG	34,86		
SWORDFISH	ITALY	HARP	1986	TYRRHENIAN	APR-AUG	21,09		
HOOKS								
ALBACORE	ITALY	LL	1984	IONIAN	SEPT-NOV	1227	77.3	15.1
ALBACORE	ITALY	LL	1984	ADRIATIC	SEPT-NOV	1633	78.9	15.7
ALBACORE	ITALY	LL	1985	IONIAN	SEPT-NOV	819.8	71.1	13.5
ALBACORE	ITALY	LL	1985	ADRIATIC	SEPT-NOV	2895	101.9	19.1
ALBACORE	ITALY	LL	1985	TYRRHENIAN	OCTO-DEC		136.5	
ALBACORE	ITALY	LL	1986	IONIAN	SEPT-NOV	335.7	63.1	12.8
ALBACORE	ITALY	LL	1986	ADRIATIC	SEPT-NOV	2336.2	109.6	22.6
ALBACORE	ITALY	LL	1986	TYRRHENIAN	OCTO-NOV		52.5	
ALBACORE	GREECE	LL	1986	AEGEAN	SEPT-NOV	160.9	100	17.4
ALBACORE	ITALY	LL	1987	IONIAN	SEPT-NOV	218.5	74.4	13.9
ALBACORE	ITALY	LL	1987	ADRIATIC	SEPT-NOV	1025	247.3	49.5
ALBACORE	ITALY	LL	1988	IONIAN	SEPT-NOV	387.5	88.3	15.5
ALBACORE	GREECE	TROL	1986	AEGEAN	SEPT-NOV	471 days	61.2/day	11.8/day
kg x fishing day								
ALBACORE	ITALY	HAND	1985	TYRRHENIAN	OCTO-DEC	255,5		
ALBACORE	ITALY	HAND	1986	TYRRHENIAN	SEPT-DEC	36,1		
kg/100 m net x day								
ALBACORE	ITALY	GILL	1985	TYRRHENIAN	APR-AUGU	0,04		
ALBACORE	ITALY	GILL	1986	TYRRHENIAN	APR-AUGU	0,12		

LL = longline; GILL = gillnet; HARP = Harpoon; TROL = Trolling; HAND = Handline.

* No new CPUE data were presented for bluefin tuna.

Table 2. Historic bluefin tagging programs carried out in the east Atlantic and Mediterranean Sea

Releasing Country and Years	No. of tunas released	Recoveries				Sources
		Total No of recoveries	Atl. to Mediterr.	Med to Atl.	Trans- Atl.	
Italy (1911-1912)	30	-	-	-	-	(1)
Portugal (1931-1935)	107	-	-	-	-	(2)
Norway (1957-1962)	237	25(10.5%)	-	-	-	(3)
Spain (Atl.) (1969-1967)	312	25(6.7%)	-	-	-	(4)
Portugal (1960)	50	-	-	-	-	(5)
Italy (1963-1968)	296	6(2.0%)	-	-	-	(6)
France-Portugal (1967-1972)	34	5(14.7%)	-	-	2	(7)
CIESM (1972)	8	-	-	-	-	(8)
Morocco (Atl.) (1972-1978)	195	21(10.8%)	-	-	-	(9)
Spain (Atl.) (1976-1989)	4674	293(6.3%)	6	-	13	See text
Spain (Med.) (1977-1984)	384	41(10.7)	-	3	-	(10)
Total	6327	412(6.5%)	12	3	15	

(1) Held, 1927; (2) Rodríguez-Roda, 1980; (3) Hamre, 1963; 1964; (4) Rodríguez-Roda, 1969; 1980; (5) Vilela, 1960; (6) Arena and Li Greci, 1970; (7) Aloncle, 1973; Mather and Mason, 1973; (8) CIESM = International Council for Scientific Exploration of the Mediterranean Sea, personal communication; (9) Lamboeuf, 1975; Brêthes, 1978; 1979; Brêthes and Mason, 1979; (10) Rey and Cort, 1978; 1986; Rey, personal communication.

Table 3. Summary of on-going tagging programs on tunas and tuna-like fishes

COUNTRY	ON-GOING TAGGING PROGRAM IN:		SPECIES EXPECTED TO BE RECOVERED	
	ATLANTIC	MEDITERRANEAN	ATLANTIC	MEDITERRANEAN
SPAIN	ALB, BFT, SWO *	BFT	ALB, BFT, SWO, SHAKS	BFT
FRANCE	-	ALB (1500 tags) (87-88-89)	-	-
YUGOSLAVIA	-	-	-	-
MOROCCO	-	-	-	-
ALGERIA	-	-	-	-
ALBANIA	-	-	-	-
GREECE	-	SWO 100 (1987)	-	-
JAPAN	SKJ *	-	SKJ	SKJ
LIBYA	-	-	-	-
ITALY	-	SWO 134 ALB 18	-	-

* Opportunistic tagging by fishermen

Table 4. Length-weight relationship for bluefin, swordfish and albacore in the Mediterranean Sea

No.	Range	Area	Sex	Equation	Period	Document
<i>Bluefin tuna</i> FL						
1		Tyrr.S.	M + F	$RW = 1.96 E^{-05} FL^{3.0092}$	May-Aug	Arena (Personal comm)
<i>Swordfish</i>						
	LJFL cm					
1 48	71-177	W. Med.	M + F	$RW = 9.62 E^{-07} LJFL^{3.533}$	March-Jun	Mejuto et al, 1987
2 462	64-205	Ionian S.	M + F	$GW = 5.70 E^{-06} LJFL^{3.16}$	Jun-Sept	De Metrio, 1987
3 960	90-206	Aegean S.	M + F	$GW = 4.75 E^{-06} LJFL^{3.17}$	Feb-Sept	Megalofonou (App. III)
4 974	55-250	Aegean S.	M + F	$GW = 7.5 E^{-06} LJFL^{3.06}$	Feb-Sept	Tsimenides & Tserpes, 1989
5 juveniles		Ion.+ Tyrr.	M + F	$GW = 4.14 E^{-07} LJFL^{3.636}$	-	Cavallaro et al
<i>Albacore</i>						
	FL cm					
1 122	32-88	Tyrr. Sea	M + F	$RW = 1.47 E^{-05} FL^{3.009}$	-	Arena et al 1978
2 867	55.2-81.8	Aegean Sea	M + F	$RW = 3.561 E^{-05} FL^{2.84}$	1986	Megalofonou (App. III)
3 379	58.2-81.7	Aegean Sea	M + F	$RW = 3.317 E^{-05} FL^{2.86}$	1987	Megalofonou (App. III)
4 496	58.7-89.0	Aegean Sea	M + F	$RW = 5.618 E^{-05} FL^{2.74}$	1989	Megalofonou (App. III)
5 164	58.7-87.0	Aegean Sea	M	$RW = 4.344 E^{-05} FL^{2.80}$	86-89	Megalofonou (App. III)
6 87	61.5-77.0	Aegean Sea	F	$RW = 4.178 E^{-05} FL^{2.81}$	86-89	Megalofonou (App. III)
7 1742	55.5-89.0	Aegean Sea	M + F	$RW = 3.119 E^{-05} FL^{2.88}$	86-89	Megalofonou (App. III)

Table 5. **Size (FL) at age for bluefin tuna**
used by the ICCAT SCRS for
the east Atlantic and
Mediterranean Sea catches
employing Farugio's (1980)
equation with an L_{∞} of 351.1 cm

AGE	FL (cm)	wt (kg)
1	54.0	3.6
2	76.8	9.9
3	97.9	19.8
4	117.4	34.5
5	135.4	50.5
6	152.0	70.5
7	167.3	93.0
8	181.4	117.5
9	194.5	143.6
10	206.5	170.7
11	217.6	198.6
12	227.9	226.9
13	237.4	255.2
14	246.1	283.3
15	254.2	310.9
16	261.6	338.0
17	268.5	364.2
18	274.9	389.7
19	280.7	414.1
20	286.1	437.6

Table 6. Growth equations for swordfish in the Atlantic and Mediterranean Sea

No.	Size range	Basic Data	Area	Sex	Equation	Author	
1	85	3-360 Lbs.*	Tags	Atlantic	F + M	Dwt = $305.6 e^{-4.652e^{-.3058t}}$	ICCAT 1989
2	455	54-215 cm	Spines	Aegean	F	FL = $193.9 (1-e^{-.342 (t + 1.21)})$	Tsimenides et al 1989
3	427		Spines	Aegean	M	FL = $220.1 (1-e^{-.251 (t + 1.52)})$	Tsimenides et al., 1989
4		Spines	Aegean	F	FL = $236.5 (1-e^{-.17 (t + 2.1)})$	Megalofonou et al., 1989	
5		Spines	Aegean	M	FL = $203.2 (1-e^{-.21 (t + 2.0)})$	Megalofonou et al., 1989	
6		Spines	Aegean	F + M	FL = $243.8 (1-e^{-.14 (t + 2.6)})$	Megalofonou et al., 1989	
7	164	Spines	Florida	F	FL = $340.0 (1-e^{-.095 (t + 2.59)})$	Berkeley et al., 1983	
8	275	Spines	Florida	M	FL = $217.4 (1-e^{-.195 (t + 2.04)})$	Berkeley et al., 1983	
9		Spines + Vert.	Medit.	F	FL = $415.5 (1-e^{-.056 (t + 3.84)})$	Cavallaro et al. (see App. III)	
10		Spines + Vert.	Medit.	M	FL = $297.1 (1-e^{-.105 (t + 4.17)})$	Cavallaro et al. (App. III)	

* Dressed weight (Dwt) at release

Table 7. Growth equations for albacore. Equation 1 is used by the ICCAT SCRS for the North Atlantic stock

No.	Size range	Basic Data	Area	Sex	Equation	Author	
1	353	46-115 cm	Spines	Atlantic	F + M	$FL = 124.7 (1 - e^{-.228(t+.989)})$	Bard & Compean, 1980
2	122	32-88 cm	Scales	Tyrrhenian	F + M	$FL = 98.6 (1 - e^{-.406(t+.63)})$	Arena et al., 1980

Table 8. Types of weight and length measurements of fish taken by each fishery

COUNTRY	SPECIES	GEAR *	TYPE OF MEASUREMENT	
			WEIGHT	LENGTH
France	ALB		Round	
	BFT	PS	Round	
Greece	ALB	LL	Round	FL
		TROLL	Round	FL
	BFT	BB	Dressed	FL
		TROLL	Dressed	FL
	SWO	LL	GG, fins & bill off	LJFL
Italy	ALB	ALL	Round	FL
	BFT	HAND + HARP	Round	FL
		LL + GILL	Round (JUVENILE)	FL
			Gutted (ADULT)	FL
	SWO	HARP	Round	LJFL
		LL + GILL	Round (JUVENILE)	LJFL
		Cen. Tyrr.** Ionian**	Gutted, bill off Gilled and gutted	LJFL LJFL
Japan	ALB	LL	Round	FL
	BFT	LL	Gilled and gutted	FL
	SWO	LL	not available	EFL
Lybia	BFT	TRAP	Round	not available
Morocco	-	-	-	-
Spain	ALB		Round	FL
	BFT	HAND	Gilled and gutted	FL
		LL	Gilled and gutted	FL
		SURF	Round	FL
		TRAP	Gilled and gutted	FL
	SWO	LL	GG and bill off, Dressed or Round	LJFL
Yugoslavia	BFT	ALL	Round	not available

* See Appendix Table A for Gear Codes.

** Some fisheries.

GG: Gilled and gutted.

FL: Fork length.

LJFL: Lower jaw-fork length.

EFL: Eye-fork length.

Table 9. Estimated bluefin catch (in number of fish) at age for the total east Atlantic and Mediterranean (as of 14:00, June 26, 1990)

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	130694	10423	115725	138102	181757	685791	93610	214061	147853	74075	110511	148702
2	76341	88641	148570	66881	130102	289266	188083	287032	195233	40217	159974	327128
3	26357	52434	73295	83399	56414	34088	279697	43050	149979	101630	118127	112433
4	16746	15130	15235	6434	63235	19638	40803	66156	28978	48658	33197	17684
5	9570	12223	7466	3184	7470	6727	20323	2254	4905	6944	8636	12187
6	8927	4146	8017	3600	5119	4732	5376	5396	1774	2647	5437	7011
7	4619	4563	4308	6822	3042	3323	3371	4214	2652	2592	3222	4032
8	3715	12279	2455	10255	5379	3442	1999	2476	1768	3764	2248	4655
9	6403	3174	3249	6560	10663	5758	3965	2705	1320	3954	2556	3572
10	8583	1905	1162	1598	4600	5743	3059	3580	3485	3501	3885	3436
11	5082	1432	1305	1828	4700	7257	4079	3827	2018	2321	3997	4247
12	3594	1553	1928	1862	6115	10354	5326	4500	3012	2129	3984	3485
13	2558	3065	2959	2677	7133	10250	7951	5131	3598	3637	3911	2019
14	2417	4304	3573	3230	6859	8198	6740	6240	5935	3246	3347	1381
15	1285	3358	2676	2549	4242	5120	4870	4992	3563	2206	2699	989
16	457	1525	1103	1477	2522	3522	3154	3299	1577	2406	1537	644
17	99	652	445	670	1311	1911	1757	1949	836	1454	566	401
18	21	256	150	196	588	742	1163	1242	823	837	192	306
19	2	18	12	41	75	206	274	409	502	164	48	108
20	0	0	6	11	57	253	423	572	625	130	8	77
TOTAL	307470	221081	393639	341376	501383	1106321	676023	663085	560436	306512	468082	654497

AGE	1982	1983	1984	1985	1986	1987	1988
1	686474	689209	258756	489810	664220	274157	922108
2	202685	164037	548279	291127	274272	442490	169792
3	206692	132656	44086	273132	150810	102888	216437
4	28442	33875	32413	30616	75636	26974	22690
5	5141	10257	22570	12843	7714	9461	7751
6	3404	3550	9928	7840	5350	7823	8268
7	6045	9194	6070	4098	2697	8059	9471
8	8431	5587	6983	3722	2248	4096	4850
9	5273	5388	11277	4088	2955	3531	6213
10	5706	13886	11663	6942	3765	5250	5562
11	7071	5764	9495	7385	5312	4312	5737
12	7908	6299	9724	6828	6355	4369	5835
13	10176	6186	5295	5126	5034	3275	5284
14	3009	4283	3354	3010	2588	1949	3335
15	1379	1050	1745	1663	1082	1317	1855
16	1061	438	1052	769	588	372	618
17	844	236	689	404	243	111	234
18	424	115	262	241	111	29	81
19	160	74	140	78	44	123	126
20	97	6	112	86	118	237	350
TOTAL	1190422	1092090	983893	1149808	1211142	900823	1396597

**Table 11. Minimum estimates of percent composition
(in number) of small fish less than 6.4 kg
for the East Atlantic and Mediterranean
bluefin stock**

Year	East Atlantic	Mediterranean	East Atlantic & Mediterranean
1975	75.1	46.2	64.9
1976	45.9	17.7	24.0
1977	51.3	51.6	51.5
1978	50.6	38.9	42.9
1979	48.7	25.6	35.0
1980	57.0	20.7	33.2
1981	63.1	11.8	26.1
1982	67.3	28.9	37.1
1983	75.3	59.0	65.0
1984	16.7	22.8	21.0
1985	20.8	58.7	53.3
1986	74.6	58.9	63.5
1987	28.4	26.8	27.2
1988	73.4	58.3	63.6

Source: ICCAT (1990).

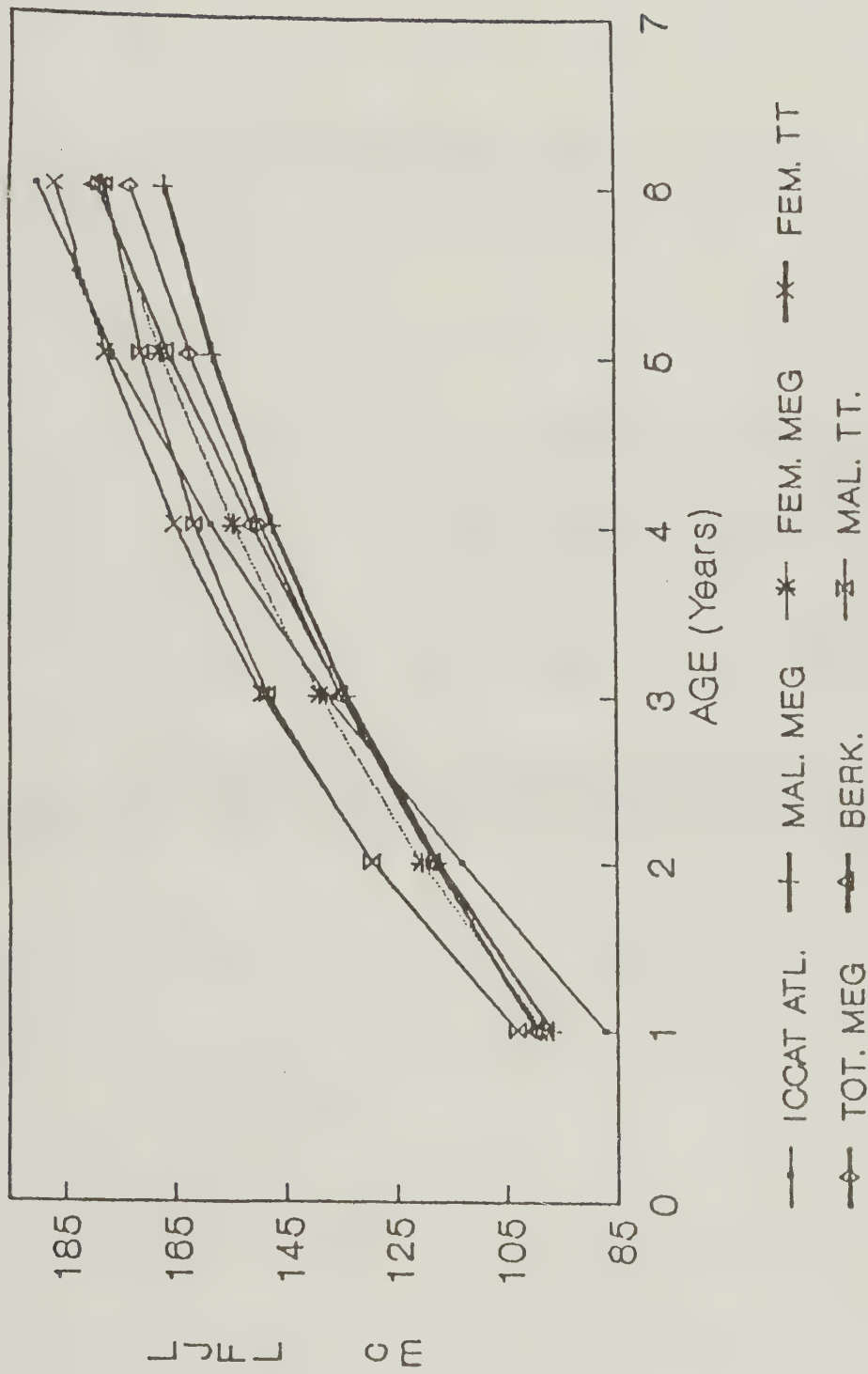


Figure 1. Estimates of length at age from various growths.

APPENDIX Table A

Nominal catches (in metric tons) of tunas and tuna-like fish in
Mediterranean waters, 1950 - 1988 (Reported by ICCAT)

NOMENCLATURE/NOMENCLATURE/NOMENCLATURA

Code Cocce Código	Scientific names Noms scientifiques Nombres científicos	English	Français	Español
SFT	Thunnus thynnus thynnus	Bluefin tuna	Thon rouge	Atún
ALB	Thunnus alalunga	Albacore	Germon	Atún blanco
BET	Thunnus obesus	Bigeye tuna	Thon obèse	Patudo
LTA	Euthynnus alletteratus	Atlantic black skipjack	Thonine	Bacoreta
SKJ	Katsuwonus pelamis	Oceanic skipjack	Listao	Listado
BON	Sarda sarda	Atlantic bonito	Bonite à dos rayé	Bonito
FRI	Auxis thazard	Frigate tuna	Auxide	Melva
BOP	Orcynopsis unicolor	Plain bonito	Palomette	Tasarte
SWO	Xiphius gladius	Broadbill swordfish	Espadon	Pez espada

- OTH
- includes figures reported as "mixed species of tunas" or "unknown species".
 - comprend des chiffres déclarés comme "espèces mêlées de thonidés" ou "espèces inconnues".
 - incluye cifras consideradas como "varias especies de atunes" o "especies no conocidas".

TYPES OF FISHERIES (GEAR)
 TYPES DE PECHERIE (ENGIN)
 TIPOS DE PESQUERIA (ARTE DE PESCA)

Code
 Code
Código

BB	Baitboat/live bait, Canneur/appât vivant, Barco de cebo/cebo vivo
BBI	Baitboat ice-well, Canneur-glacier, Barco de cebo depósito de hielo
BBF	Baitboat-freezer, Canneur-congélateur, Barco de cebo congelador
BLL	Bottom longline, Palangre de fond, Palangre de fondo
GILL	Gill-net, Filet maillant, Red de enmalle
HAND	Hand-line, Ligne à main, Liña
HARP	Harpoon, Harpon, Arpón
HS	Haul seine, Senne de plage, Red de playa
LL	Longliner, Palangrier, Palangrero
LLD	Longline discards, Rejets palangre, Descartes de palangrero
LLFB	Individual foreign-based longliner, Palangrier individuel basé à l'étranger, Palangrero con base en país extranjero
LLHB	Individual home-based longliner, Palangrier individuel basé dans son propre pays, Palangrero individuel con base en su propio país
LLMB	Deckloaded-type motherboat longliner, Bateau mère transporteur de palangriers, Buque nodriza transporte de palangreros
MWT	Mid-water trawl, Chalut pélagique, Arrastre meso-epipelágico
MWTD	Double boat mid-water trawl, Chalut pélagique travaillant en paire, Arrastre meso-epipelágico dos embarcaciones
PS	Purse seiner, Senneur, Barco de cerco
PSG	Large size purse seiner, Grand senneur, Cerquero grande
PSM	Medium size purse seiner, Senneur moyen, Cerquero mediano
PSS	Small purse seiner, Petit senneur, Cerquero pequeño
PSD	Double-boat purse seiners, Senneurs travaillant en paire, Redes de cerco con dos embarcaciones
PSLB	Purse seiner with live bait, Senneur avec appât vivant, Cerquero con cebo vivo
R R	Rod-and-reel, Canne et moulinet, Caña y carrete
SPHL	Sport handline, Ligne à main sportive, Liña deportiva
SPOR	Sport fisheries unclassified, Pêche sportive non spécifiée, Pesca deportiva sin especificar
SURF	Surface fisheries unclassified, Pêcheries de surface non spécifiées, Pesquerías de superficie sin especificar
TN	Trammel net, Tramail, Trasmallo
TRAP	Trap, Madrague, Almadraba
TRAW	Trawl, Chalut, Arrastre
TROL	Troller, Ligneur, Curricán (Cacea)
UNCL	Unspecified methods, Méthodes non spécifiées, Métodos sin especificar

BLUEFIN TUNA

AREA	COUNTRY	GEAR	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
MEDI	ALGERIE	TRAP	100G	100G	100G	98N	62N	98N	56N	52N	78N	++F
MEDI	FRANCE	UNCL	507E	816E	966E	899E	798N	783E	329E	615E	294E	384E
MEDI	GREECE	UNCL	400G	400G	400F	800F	600F	1200F	900F	500F	700F	700F
MEDI	ITALY	PSFB	0	0	722	423	263	296	153	129	158	60
MEDI	ITALY	PSFS	0	0	0	53	329	259	213	110	59	104
TYRR	ITALY	TRAP	2200F	1978	1044	2007	1752	1589	1560	2571	2736	1823
MEDI	LIBYA	TRAP	1000F	1100F	900F	1700F	1200G	1200G	1200G	1200G	1200F	1100G
MEDI	MALTA	UNCL	100F	100F	100F	100F	100F	100F	100F	100F	100F	100F
MEDI	ESPANA	TRAP	168N	273N	553N	54N	597N	60N	136N	345N	282N	374N
MEDI	TUNISIE	TRAP	465G	410G	290G	320G	355	301	0G	34	0G	85
MEDI	TURKEY	UNCL	**G	**G	**G	**G	**G	**G	**G	800F	400F	500F
MEDI	YUGOSLAV	PS	657	531	279	588	654	346N	253	382	388	224N
TOTAL			5597	5708	5354	7042	6710	6232	4900	6838	6395	5454

AREA	COUNTRY	GEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
MEDI	ALGERIE	TRAP	++F	++F	**F	++F	++F	++F	150N	150N	150N	150N
MEDI	FRANCE	GILL	400E	599E	214E	668E	953E	390E	0	0	0	0
MEDI	FRANCE	PSM	0	0	0	0	0	0	1000E	1500N	2500N	1500N
MEDI	GREECE	UNCL	900G	1100F	1000F	1200F	600F	700F	500F	600F	500F	500F
MEDI	ITALY	PSFB	69	244	171	989	896	155	410	792	366	729
MEDI	ITALY	PSFS	47	105	161	267	94	146	220	296	325	1099
TYRR	ITALY	TRAP	1229	1423	1280	1227	1652	1264	945	1949	1739	1324
MEDI	LIBYA	TRAP	1100G	1000F	800F	100F	400F	600F	700F	800F	1000F	2000F
MEDI	MALTA	UNCL	100F	100F	100F	100F	100F	100F	100F	100F	100F	++F
MEDI	MAROC	TRAP	0	0	0	0	0	172	11	27	5	0
MEDI	ESPANA	LLHB	0	0	0	800N	300N	400	500	300N	600	400
MEDI	ESPANA	TRAP	561N	620N	377N	472N	653N	1235N	151N	104N	4N	217N
MEDI	TUNISIE	TRAP	0G	0G	404E	260E	376E	601E	293E	307E	184E	77E
MEDI	TURKEY	UNCL	300F	300F	200F	100F	0F	100F	100F	1488	310	393
MEDI	YUGOSLAV	PS	109N	123N	87N	277N	271N	134N	246N	331N	150N	301N
TOTAL			4815	5614	4794	6460	6295	5997	5326	8744	7933	8690

AREA	COUNTRY	GEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MEDI	ALGERIE	UNCL	100E	100F	1F	++F	33F	66F	49F	40F	20F	150F
MEDI	FRANCE	PSM	1100N	2200N	1100N	1400N	1800N	1600N	3800N	3182	1566	1527
MEDI	FRANCE	UNCL	0	0	0	0	0	0	0	0	31	51
ADRI	ITALY	PSFS	0	496	95A	117A	0	0	597A	47A	125A	400A
LIGU	ITALY	PSFS	0	0	1668A	1358A	2880N	2100N	4890A	1205A	2438A	450A
TYRR	ITALY	HAND	100N	100N	100N	100N	100N	100N	100N	100N	88E	120N
TYRR	ITALY	HARP	0	0	0	0	0	0	12	34	22	0
TYRR	ITALY	PSFB	1203	840	1020N	1225N	3120N	4170N	4120N	4179N	2100N	2855N
TYRR	ITALY	TRAP	961	1044	835	367	739	713	650	698	210	195
MEDI	JAPAN	LLHB	0	0	112	246	2195	1260	968	520	61	99
MEDI	LIBYA	UNCL	500F	600F	300F	400F	500F	634F	799F	336F	677F	424F
MEDI	MALTA	UNCL	++F	++F	++F	++F	21F	37F	25F	47F	26F	23F
MEDI	MAROC	PS	0	42E	1E	0	2E	40E	1E	7E	0	2
MEDI	MAROC	TRAP	0	37	36	1	7	0	0	0	0	0
MEDI	PANAMA	LLFB	0	0	0	0	0	0	0	4G	0	0
MEDI	ESPANA	LLHB	69E	129E	124N	274N	192N	103N	250N	68L	92N	100N
MEDI	ESPANA	SPOR	0	0	0	0	0	14N	0	88N	72N	15N
MEDI	ESPANA	TRAP	280N	53N	88N	146N	11N	3N	3N	2N	1N	0
MEDI	TUNISIE	TRAP	248E	238E	64E	52E	123E	101E	65E	120E	120G	131N
MEDI	TURKEY	UNCL	138	22	68	66	34	17	181	177	127	27
MEDI	YUGOSLAV	PS	90N	326N	200N	224N	317N	155N	562N	932N	1049	756
TOTAL			4789	6227	5812	5976	12074	11113	17072	11786	8825	7325

BFT CONT.

AREA	COUNTRY	GEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988
MEDI	ALGERIE	UNCL	190F	220F	250F	252F	254F	260F	566	420	677
MEDI	FRANCE	PSM	1701	2300	4818	3600	3570	5400	3460	4300	5750
MEDI	FRANCE	SPOR	0	20	30	30	30	30	30	30	30
MEDI	FRANCE	UNCL	0	30	30	30	0	0	0	0	0
MEDI	GREECE	UNCL	0	0	0	0	0	131G	131N	131E	131E
ADRI	ITALY	HAND	0	0	0	0	10E	10E	10E	10E	10E
ADRI	ITALY	PSFS	1000E	1000E	1000E	1000E	1913	740	1500G	1500G	1500N
ADRI	ITALY	R R	0	0	0	0	10E	50E	50E	50E	50E
LIGU	ITALY	PSFS	1759N	2992N	3260N	1992N	993	2329	2207N	522G	395N
LIGU	ITALY	SPOR	0	0	0	0	10	50	50G	53G	51G
TYRR	ITALY	GILL	0	0	0	0	100	100	45	0	0
TYRR	ITALY	HAND	0	0	0	0	10	10	0	0	0
TYRR	ITALY	HARP	0	56N	24N	0	0	0	0	0	0
TYRR	ITALY	LLHB	0	0	0	29N	41	62	1	65G	63G
TYRR	ITALY	PSFB	3361N	1712N	2182N	2560N	2476	1453	1082N	557G	334N
TYRR	ITALY	TRAP	152N	209N	155N	284N	327	295	293	310G	301G
TYRR	ITALY	UNCL	0	48N	37N	0	1250	2100	2338	1495G	1452G
MEDI	JAPAN	LLHB	119	100	961	677	1036	873	421E	280	236P
MEDI	LIBYA	TRAP	339	255	130	0	0	0	0	0	0
MEDI	LIBYA	UNCL	59G	16G	180G	300F	300F	300F	300F	300F	300F
MEDI	MALTA	UNCL	24F	32F	40F	31F	21F	21F	41F	36F	25
MEDI	MAROC	PS	++	2	++	0	0	0	0	0	0
MEDI	MAROC	SURF	0	0	0	1N	4N	12	18	0	44
MEDI	MAROC	TRAP	0	0	0	0	0	0	0	337A	96A
MEDI	ESPANA	BB	0	100N	53N	0	1699N	278N	0	0	0
MEDI	ESPANA	GILL	0	0	0	0	3N	2N	0	0	0
MEDI	ESPANA	HAND	0	0	0	151N	145N	267N	29N	177N	553N
MEDI	ESPANA	LLHB	100N	200N	538N	233N	69N	129N	117N	116N	135N
MEDI	ESPANA	PS	0	50N	277N	0	79N	56N	22N	0	0
MEDI	ESPANA	SPOR	33N	1N	55N	0	0	0	0	0	0
MEDI	ESPANA	SURF	0	0	0	391N	26N	415N	220N	404N	225N
MEDI	ESPANA	TRAP	0	3N	66N	37N	621N	302N	168N	219N	228N
MEDI	ESPANA	UNCL	0	0	0	0	101N	22N	0	0	0
MEDI	TUNISIE	PS	0	0	0	0	0	0	0	0	120E
MEDI	TUNISIE	TRAP	120G	98G	100G	80G	80G	80G	84F	83F	83G
MEDI	TURKEY	PS	0	0	0	0	0	2230	1524	910	910F
MEDI	TURKEY	UNCL	391	565	825F	557F	869	0	0	0	0
MEDI	YUGOSLAV	PS	573	376N	486	1222N	755N	1084N	796N	648N	1523N
TOTAL			9921	10385	15497	13457	16802	19091	15503	12953	15222

SUORDFISH

AREA	COUNTRY	GEAR	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
MEDI	ITALY	UNCL	**G	**G	**G	**G	**G	**G	**G	**G	**G	**G
MEDI	MALTA	UNCL	**G	**G	**G	**G	**G	**G	**G	**G	**G	**G
MEDI	ESPANA	LLHB	586N	580N	337N	0	452N	340N	393N	0	414N	0
MEDI	TURKEY	UNCL	**G	**G	**G	**G	**G	**G	**G	**G	500F	200F
TOTAL			586	580	337	**	452	340	393	**	914	200
AREA	COUNTRY	GEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
MEDI	ITALY	UNCL	**G	**G	**G	**G	**G	**G	**G	1900F	1400F	2000F
MEDI	LIBYA	UNCL	0	0	0	0	0	200F	200F	300F	500F	++F
MEDI	MALTA	UNCL	**G	**G	**G	**G	**F	++F	++F	++F	++F	++F
MEDI	MAROC	LL	0	94A	188A	94A	282A	223A	192A	165A	196A	250A
MEDI	MAROC	TRAP	0	0	0	0	0	1	0	1	1	0
MEDI	ESPANA	LLHB	0	0	0	0	0	1200N	1000N	700N	1000N	1100E
MEDI	TURKEY	UNCL	100F	100F	100F	200F	100F	100F	300F	99	103	119
TOTAL			100	194	288	294	382	1724	1692	3169	3200	3469

SUORDFISH CONT.

AREA	COUNTRY	GEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MEDI	ALGERIE	UNCL	**F	++F	++F	100F	196F	500F	368F	370F	320F	521F
MEDI	CYPRUS	LL	0	0	++F	++F	++F	5	59	95	82	98
MEDI	ITALY	HARP	0	0	0	0	0	0	279A	372A	675A	424A
MEDI	ITALY	LLHB	0	0	0	0	0	0	3067A	2973A	3348A	3085A
MEDI	ITALY	UNCL	1800F	2900F	3700F	2800N	3330N	3002N	0	0	0	0
MEDI	JAPAN	LLHB	0	0	0	0	0	0	1	0	2	3
MEDI	MALTA	UNCL	100F	200F	200F	200F	171F	191F	156F	199F	121F	135F
MEDI	MAROC	LL	214A	326A	229A	183	193A	118	186A	144	172A	0
MEDI	MAROC	TRAP	0	1	1	0	3	0	0	0	0	0
MEDI	ESPANA	LLHB	900L	1100L	1300L	1105L	700L	89L	89L	667L	720N	800N
MEDI	TUNISIE	UNCL	++F	++F	++F	++F	5F	3F	5F	0	0	0
MEDI	TURKEY	UNCL	88	76	60	59	15	10	7	34	20	44
TOTAL			3102	4603	5490	4447	4613	3918	4217	4854	5460	5110

AREA	COUNTRY	GEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988
MEDI	ALGERIE	UNCL	650F	760F	870F	877F	884F	890F	847	1820	2621
MEDI	CYPRUS	LL	72	78	103	28	63	71	154	84	121
MEDI	GREECE	LL	0	91N	690N	689N	965N	925N	1530N	1163N	1251F
MEDI	ITALY	GILL	0	0	0	0	1303	1375	1446A	1562G	1648G
MEDI	ITALY	HARP	447A	412A	318A	327A	0	0	0	0	0
MEDI	ITALY	LLHB	3252A	3002A	2306A	2375A	2463	2226	2341A	2528G	2669G
MEDI	ITALY	TRAP	0	0	0	0	3	0	0	0	0
MEDI	ITALY	UNCL	0	0	0	0	4588	6098	6403A	6915G	7299G
MEDI	JAPAN	LLHB	1	1	5	6	19	14	7	3	4
MEDI	MALTA	UNCL	198F	171F	158F	53F	84F	96F	87F	117F	185
MEDI	MAROC	LL	++	++	0	43N	39N	37	99	39A	62
MEDI	ESPANA	HAND	0	0	0	0	0	1N	0	0	0
MEDI	ESPANA	LLHB	750E	1120N	900N	1321N	1243N	1219N	1337N	1134N	1760N
MEDI	ESPANA	SURF	0	0	0	0	0	2N	0	0	0
MEDI	ESPANA	TRAP	0	0	0	1N	2N	3N	0	0	2N
MEDI	ESPANA	TRAW	0	0	0	0	0	1N	0	0	0
MEDI	ESPANA	UNCL	0	0	0	0	0	1N	0	0	0
MEDI	TUNISIE	UNCL	0	7F	19F	15G	15G	61F	64F	63F	80F
MEDI	TURKEY	GILL	0	0	0	0	0	190F	226	557	557F
MEDI	TURKEY	UNCL	13	70	40F	216F	95F	0	0	0	0
TOTAL			5383	5712	5409	5951	11766	13210	14541	15985	18259

ALBACORE

AREA	COUNTRY	GEAR	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
MEDI	MALTA	UNCL	++F	++F	++F	++F	++F	++F	++F	++F	++F	++F
TOTAL			++	++	++	++	++	++	++	++	++	++

AREA	COUNTRY	GEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
MEDI	ITALY	UNCL	0	0	0	0	0	500F	500F	500F	500F	500F
MEDI	MALTA	UNCL	++F	++F	**F	**F	**F	++F	++F	++F	++F	0F
MEDI	YUGOSLAV	PS	0	0	0	0	0	0	0	0	0	200F
TOTAL			++	++	**	**	**	500	500	500	500	700

AREA	COUNTRY	GEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MEDI	ITALY	LLHB	0	0	0	0	0	0	40	130	150	0
MEDI	ITALY	UNCL	500F	500F	500F	500F	500	500	520	483	440	833
MEDI	JAPAN	LLHB	0	0	1	0	0	0	1	0	0	0
MEDI	ESPANA	UNCL	0	0	200L	0	0	0	0	0	0	0
TOTAL			500	500	701	500	500	500	561	613	590	833

ALBACORE CONT

AREA	COUNTRY	GEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988
MEDI	FRANCE	PSM	0	0	0	0	141	250	10	50	16
MEDI	FRANCE	SPOR	0	0	0	0	0	0	10	10	15
MEDI	GREECE	UNCL	0	0	0	0	0	0	484N	500E	500E
MEDI	ITALY	GILL	0	0	0	0	191	385	100A	107G	110G
MEDI	ITALY	LLHB	0	0	0	0	226	375	150A	161G	165G
MEDI	ITALY	UNCL	500N	600N	700N	700G	1525	2588	2958A	3165G	3254G
MEDI	ESPANA	BB	0	900N	539N	535N	1331N	243N	0	0	0
MEDI	ESPANA	LLHB	0	0	0	0	0	0	0	0	3N
MEDI	ESPANA	PS	0	0	0	0	0	24N	0	0	0
MEDI	ESPANA	TROL	0	0	33N	0	0	264N	0	0	0
TOTAL			500	1500	1272	1235	3414	4129	3712	3993	4063

ATLANTIC BLACK SKIPJACK

AREA	COUNTRY	GEAR	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
MEDI	ESPANA	TRAP	138N	228N	3N	38N	4N	9N	81N	0	0	0
MEDI	YUGOSLAV	PS	18	23	11	6	126	47	13	22	47	11
TOTAL			156	251	14	44	130	56	94	22	47	11

AREA	COUNTRY	GEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
MEDI	CYPRUS	UNCL	0	0	0	0	0	6F	9F	14F	12F	9F
MEDI	MAROC	SURF	0	0	0	0	0	0	0	0	0	1
MEDI	MAROC	TRAP	0	0	0	0	0	3	0	5	12	2
MEDI	ESPANA	SURF	0	0	23N	6N	31N	26N	12N	4N	139N	931N
MEDI	ESPANA	TRAP	1N	0	6N	4N	15N	5N	3N	8N	0	0
MEDI	YUGOSLAV	PS	12	24	2	8	2	2	3	7	5	8
TOTAL			13	24	31	18	48	42	27	38	168	951

AREA	COUNTRY	GEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MEDI	CYPRUS	UNCL	14F	17F	6F	6F	5F	7F	7F	18F	11F	17F
MEDI	ISRAEL	UNCL	100F	100F	100F	100F	242F	200F	300F	300F	200F	170F
MEDI	ITALY	UNCL	0	0	0	0	0	0	0	0	0	**N
MEDI	MAROC	SURF	0	36	0	12	0	63	0	1	0	6
MEDI	MAROC	TRAP	2	1	3	4	5	0	4	3	0	0
MEDI	ESPANA	SURF	590N	372N	566N	716N	688N	732N	1134N	1059N	1153N	993N
MEDI	ESPANA	TRAP	0	0	0	0	0	0	0	0	39N	0
MEDI	SYRIA	UNCL	0G	0F	0F	0F	0F	0F	102F	105F	109F	89F
MEDI	YUGOSLAV	PS	5	4	12	9	4	20	2	4	0	0
TOTAL			711	530	687	847	944	1022	1549	1490	1512	1275

AREA	COUNTRY	GEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988
MEDI	CYPRUS	UNCL	17F	22F	33F	17F	31F	32F	13F	25F	41F
MEDI	ISRAEL	UNCL	105F	35F	110F	35F	60F	259F	284F	273F	273F
MEDI	MAROC	SURF	0	62	12	0	2N	++	++	0	12
MEDI	ESPANA	GILL	0	0	0	0	0	10N	++N	0	0
MEDI	ESPANA	PS	0	0	0	0	8N	0	0	0	0
MEDI	ESPANA	SURF	800N	0	705N	0	3N	0	0	0	0
MEDI	ESPANA	TRAP	0	6N	0	0	21N	2N	5N	++N	5N
MEDI	SYRIA	UNCL	80F	73F	90F	80F	96F	80F	41F	57F	81F
MEDI	YUGOSLAV	PS	0	0	0	1N	6N	1N	1N	2N	5N
TOTAL			1002	198	950	133	227	384	344	357	417

BONITO

AREA	COUNTRY	GEAR	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
MEDI	ALGERIE	UNCL	**G	**G	**G	**G	**G	**G	**G	**G	**G	**G
MEDI	BULGARIA	UNCL	**G	**G	**G	**G	**G	**G	**G	**G	**G	**G
MEDI	GREECE	UNCL	200G	200G	200F	500F	3400F	6600F	2400F	4800F	1300F	900F
MEDI	ITALY	UNCL	**G	**G	**G	**G	**G	**G	**G	**G	**G	**G
MEDI	ESPANA	TRAP	236N	165N	91N	274N	296N	296N	98N	0	109N	0
MEDI	TURKEY	UNCL	**G	**G	**G	6000F	14700F	49000F	55500F	39300F	27200F	10600F
MEDI	YUGOSLAV	PS	47	48	36	21	40	311	180	27	13	30
TOTAL			483	413	327	6795	18436	56207	58178	44127	28622	11530
AREA	COUNTRY	GEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
MEDI	ALGERIE	UNCL	**G	**G	**G	**G	100F	200F	300F	200F	100F	100F
MEDI	BULGARIA	UNCL	**G	**G	**G	**G	**G	1683F	1475F	2281F	1784F	2079F
MEDI	GREECE	UNCL	1400G	1900F	2000F	2200F	900F	3200F	2300F	1800F	1700F	2000F
MEDI	ITALY	UNCL	600F	2000F	1100F	1000F	1000F	852F	969F	1413F	836F	969F
MEDI	MAROC	SURF	0	0	0	0	0	26	9	115	16	17
MEDI	MAROC	TRAP	0	0	0	0	0	4	6	10	7	3
MEDI	ROUMANIE	UNCL	0	0	0	0	0	0	0	0	0	++F
MEDI	ESPANA	SURF	0	0	578N	424N	214N	374N	504N	628N	287N	248N
MEDI	ESPANA	TRAP	139N	28N	6N	77N	52N	32N	111N	89N	67N	90N
MEDI	TUNISIE	UNCL	0	0	0	0	0	**F	**F	**F	**F	**F
MEDI	TURKEY	UNCL	32200F	41800F	3800F	19100F	11200F	20600F	16100F	34514	21343	50089
MEDI	USSR	UNCL	0	0	0	0	++	++	200	100	100	++
MEDI	YUGOSLAV	PS	20	82	42	34	22	30	138	56	28	17
TOTAL			34359	45810	7526	22835	13488	27001	22112	41206	26268	55612
AREA	COUNTRY	GEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MEDI	ALGERIE	UNCL	++F	31F	222F	343F	183F	140F	143F	206F	196F	515F
MEDI	BULGARIA	UNCL	++F	100F	++G	++F	++F	++G	40F	44F	11F	1F
MEDI	CYPRUS	UNCL	0	0	++F	++F	++F	++F	++F	++F	0	0
MEDI	EGYPT	UNCL	0F	0F	0F	0F	10F	3F	0F	1F	17F	10F
MEDI	GREECE	UNCL	900F	600F	600F	500F	487F	658F	511F	550F	610F	712F
MEDI	ITALY	UNCL	914F	1064F	965F	715F	760	959F	955F	1533F	1378F	1403F
MEDI	MALTA	UNCL	0	++F	++F	++F	2F	5F	1F	2F	2F	1F
MEDI	MAROC	SURF	22	37	42	295	90	135	628	450	128F	155
MEDI	MAROC	TRAP	3	17	12	13	40	0	2	6	0	0
MEDI	ROUMANIE	UNCL	++F	++F	0	0	0	0	2F	0	0	0
MEDI	ESPANA	SURF	508N	817N	198N	250N	219N	289N	364N	565N	598N	540N
MEDI	ESPANA	TRAP	150N	71N	68N	30N	71N	40N	33N	45N	113N	173N
MEDI	TUNISIE	UNCL	117F	251F	200F	203F	499F	429F	619F	768F	791F	865F
MEDI	TURKEY	UNCL	18057	25229	13905	3901	5324	3371	3178	4503	5536	9082
MEDI	USSR	UNCL	++	0	0	0	0	0	0	0	0	0
MEDI	YUGOSLAV	PS	10	13	13	4	10	9	23	26	39	29N
TOTAL			20681	28230	16225	6254	7695	6038	6499	8699	9419	13486
AREA	COUNTRY	GEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	
MEDI	ALGERIE	UNCL	640F	740F	860F	867F	874F	880F	459	203	625	
MEDI	BULGARIA	UNCL	13F	191F	4F	24F	1F	1F	0	13F	0	
MEDI	CYPRUS	UNCL	0	0	0	0	0	0	0	0	0F	
MEDI	EGYPT	UNCL	3F	2F	23F	14F	48F	62F	68F	90F	90F	
MEDI	FRANCE	PSM	0	0	0	0	0	0	0	0	10	
MEDI	FRANCE	UNCL	0	0	0	33F	16F	**F	0	0	0	
MEDI	GREECE	UNCL	809F	1251F	1405F	1367F	1732F	1650F	1321F	1321F	1321F	
MEDI	ITALY	UNCL	1180F	1096F	1102F	1806F	2777F	1437F	1437F	2148F	2242F	
MEDI	MALTA	UNCL	1F	++F	++F	1F	++F	++F	++F	++F	++F	
MEDI	MAROC	SURF	62	309	36	92N	74N	56	41	0	107	
MEDI	ESPANA	GILL	0	0	0	0	0	223N	245N	0	0	
MEDI	ESPANA	PS	0	0	0	969N	634N	617N	430N	0	0	
MEDI	ESPANA	SURF	380N	560N	803N	44N	100N	50N	6N	0	893N	
MEDI	ESPANA	TRAP	100N	150N	187N	212N	250N	155N	48N	51N	69N	
MEDI	TUNISIE	UNCL	700F	381F	748F	600G	600G	482F	504F	500F	600F	
MEDI	TURKEY	PS	0	0	0	0	0	12809F	11426	17333	17333F	
MEDI	TURKEY	UNCL	14910	24300F	25978F	29485F	7818F	0	0	0	0	
MEDI	YUGOSLAV	PS	72	39	61	31N	37N	34N	38N	62N	36N	
TOTAL			18870	29019	31207	35545	14961	18456	16023	21721	23326	

PLAIN BONITO

AREA	COUNTRY	GEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
MEDI	MAROC	SURF	0	0	0	0	0	1	1	48	4	3
TOTAL			0	0	0	0	0	1	1	48	4	3

AREA	COUNTRY	GEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MEDI	MAROC	SURF	3	7	6	3	7	0	0	135	153F	28
TOTAL			3	7	6	3	7	0	0	135	153	28

AREA	COUNTRY	GEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988
MEDI	MAROC	SURF	++	++	0	0	0	9	1	0	8
TOTAL			++	++	0	0	0	9	1	0	8

FRIGATE TUNA

AREA	COUNTRY	GEAR	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
MEDI	ITALY	UNCL	**G	**G	**G	**G	**G	**G	**G	**G	**G	**G
MEDI	MALTA	UNCL	**G	**G	**G	**G	**G	**G	**G	**G	**G	**G
MEDI	ESPANA	TRAP	722N	372N	176N	772N	612N	877N	1324N	0	1614N	0
MEDI	YUGOSLAV	PS	29	52	36	22	77	195	68	32	86	72
TOTAL			751	424	212	794	689	1072	1392	32	1700	72

AREA	COUNTRY	GEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
MEDI	ITALY	UNCL	600F	1000F	700F	800F	500F	700F	900F	1200F	1200F	1100F
MEDI	MALTA	UNCL	**G	**G	100G	100G	++F	++F	++F	++F	++F	++F
MEDI	MAROC	SURF	0	87A	261A	741A	653A	11	11	30	11	5
MEDI	MAROC	TRAP	0	0	0	0	0	457	352	380	640	75
MEDI	ESPANA	SURF	0	2481N	2872N	2138N	1161N	1175N	1080N	2571N	827N	1051N
MEDI	ESPANA	TRAP	880N	0	16N	536N	412N	196N	342N	322N	350N	499N
MEDI	YUGOSLAV	PS	43	35	41	75	68	52	47	58	50	56
TOTAL			1523	3603	3990	4390	2794	2591	2732	4561	3078	2786

AREA	COUNTRY	GEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MEDI	CYPRUS	UNCL	++F	++F	++F	++F	++F	++F	++F	++F	0	0
MEDI	ITALY	UNCL	1100F	1600F	1700F	1200F	1300	939F	912F	1147F	1177F	1342F
MEDI	MALTA	UNCL	++F	++F	++F	++F	7F	18F	15F	9F	33F	11F
MEDI	MAROC	SURF	8	16	65	299	62	0	130	109	69F	73
MEDI	MAROC	TRAP	99	156	130	147	346	0	227	125	0	0
MEDI	ESPANA	SURF	1845N	1869N	1074N	1463N	1873N	1269N	1417N	765N	1333N	1627N
MEDI	ESPANA	TRAP	127N	205N	270N	243N	462N	120N	218N	419N	343N	144N
MEDI	TUNISIE	UNCL	294F	202F	4F	154G	235F	123G	1209G	1099G	898G	1500G
MEDI	YUGOSLAV	PS	24	29	21	12	22	16	18	24	23	17N
TOTAL			3497	4077	3264	3518	4307	2485	4146	3697	3876	4714

AREA	COUNTRY	GEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988
MEDI	CYPRUS	UNCL	0	0	0	0	0	0	0	0	0F
MEDI	GREECE	UNCL	0	516N	2192N	1887N	2060N	1419N	0	0	0
MEDI	ITALY	UNCL	1376F	1193F	1299F	1494F	1610F	1344F	1344F	906F	609F
MEDI	MALTA	UNCL	18F	4F	9F	11F	4F	1F	13F	5F	8F
MEDI	MAROC	SURF	10	14	0	57N	37N	49	251	0	811
MEDI	ESPANA	GILL	0	0	0	0	0	39N	2N	0	0
MEDI	ESPANA	PS	0	0	0	1629N	1605N	1392N	1297N	0	0
MEDI	ESPANA	SURF	2100N	1600N	1732N	0	41N	3N	0	0	1327N
MEDI	ESPANA	TRAP	20N	100N	203N	506N	655N	613N	256N	631N	1342N
MEDI	YUGOSLAV	PS	19	14N	14	18	16N	14	32N	14N	41N
TOTAL			3543	3441	5449	5602	6028	4874	3195	1556	4138

SKIPJACK

AREA	COUNTRY	GEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
MEDI	MAROC	TRAP	0	0	0	0	0	0	0	0	1	0
TOTAL			0	0	0	0	0	0	0	0	1	0
AREA	COUNTRY	GEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MEDI	MAROC	BB	0	2	0	0	0	6	0	1	0	0
MEDI	MAROC	PS	0	0	0	0	0	0	0	0	0	11
TOTAL			0	2	0	0	0	6	0	1	0	11
AREA	COUNTRY	GEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	
MEDI	MAROC	SURF	0	0	0	1N	++N	13	1	0	++	
MEDI	ESPANA	BB	0	0	0	0	10N	0	0	0	0	
MEDI	ESPANA	TRAP	0	0	0	1N	0	0	0	0	0	
TOTAL			0	0	0	2	10	13	1	0	++	

BIGEYE TUNA

AREA	COUNTRY	GEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MEDI	JAPAN	LLHB	0	0	0	0	0	0	1	0	0	0
TOTAL			0	0	0	0	0	0	1	0	0	0
AREA	COUNTRY	GEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	
MEDI	JAPAN	LLHB	0	0	0	0	0	0	1	0	0	
TOTAL			0	0	0	0	0	0	1	0	0	

OTHERS OR MIXED SPECIES

AREA	COUNTRY	GEAR	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
MEDI	ISRAEL	UNCL	100G	100G	100F	200F	200F	100F	200F	300F	500F	500F
MEDI	MALTA	UNCL	**G	**G	**G	**G	**G	**G	**G	**G	**G	**G
MEDI	ESPANA	TRAP	0	0	0	0	0	0	0	0	21N	0
TOTAL			100	100	100	200	200	100	200	300	521	500
AREA	COUNTRY	GEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
MEDI	ISRAEL	UNCL	500F	700F	1000F	900F	1100F	200F	300F	OG	300F	200F
MEDI	LEBANON	UNCL	600F	500F	400F	500F	500F	500F	300F	200F	300F	800F
MEDI	MALTA	UNCL	**G	**G	**G	**G	**F	++F	++F	++F	++F	++F
MEDI	ESPANA	UNCL	0	0	0	700N	500N	600	600	300	500	200
TOTAL			1100	1200	1400	2100	2100	1300	1200	500	1100	1200
AREA	COUNTRY	GEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
MEDI	LEBANON	UNCL	200F	200F	200F	200F	260F	200F	140F	130F	140F	140F
MEDI	MALTA	UNCL	++F	++F	++F	100F	14F	39F	9F	30F	2F	11F
MEDI	ESPANA	UNCL	300L	0	0	0	0	337L	0	0	0	0
MEDI	TUNISIE	UNCL	52G	262G	336G	148G	142G	204G	360G	299G	265G	112G
TOTAL			552	462	536	448	416	780	509	459	407	263
AREA	COUNTRY	GEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	
MEDI	EGYPT	UNCL	0	0	0	0	0	32F	68F	80F	80F	
MEDI	GREECE	UNCL	0	0	195F	135F	40F	128F	128F	128F	128F	
MEDI	ITALY	UNCL	18F	0	0	0	0	0	0	0	0	
MEDI	LEBANON	UNCL	140F	130F	120F	110F	100F	120F	130F	150F	150F	
MEDI	MALTA	UNCL	4F	10F	21F	11F	14F	54F	12F	11F	6F	
MEDI	TUNISIE	TRAP	40G	0	100G	0	0	0	0	0	0	
MEDI	TUNISIE	UNCL	1786F	1344G	1350G	1164G	1273G	1791F	1872F	1858F	2991F	
TOTAL			1988	1484	1786	1420	1427	2125	2210	2227	3355	

APPENDIX Table B

Catch (in number of fish) at age estimated
for major countries and fisheries

NATION = ALGERIA GEAR = OTHER														
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981		
1	0	0	0	0	0	0	0	0	0	0	0	0		
2	0	0	0	0	0	0	0	0	0	0	0	1		
3	0	0	0	0	0	0	0	0	0	0	0	2		
4	24	2	0	0	2	10	3	1	0	0	15	134		
5	12	5	0	0	7	34	12	6	0	0	19	143		
6	12	16	0	0	9	37	26	21	4	0	27	86		
7	12	43	0	0	13	22	21	18	4	0	23	103		
8	24	36	0	0	14	35	10	3	5	0	34	146		
9	130	25	0	0	9	20	6	2	5	11	39	105		
10	154	17	0	0	6	16	7	5	7	61	95	133		
11	160	27	0	0	11	29	15	10	8	47	101	170		
12	18	24	0	0	12	46	24	16	5	60	104	112		
13	12	58	1	0	19	40	25	19	9	107	124	66		
14	0	70	1	0	20	30	23	20	11	67	75	49		
15	0	47	1	0	13	16	17	16	7	48	77	28		
16	0	19	0	0	5	7	10	9	4	61	38	21		
17	0	14	0	0	4	2	9	10	5	27	13	13		
18	0	5	0	0	1	0	3	3	3	20	4	6		
19	0	0	0	0	0	0	1	1	1	0	0	4		
20	0	0	0	0	0	1	3	3	0	0	0	2		
Total	558	408	3	0	145	344	213	163	77	509	790	1390		

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	2	4644	41924	151	0	33
2	1	12	4374	822	561	283	325
3	186	16	611	0	1197	150	1326
4	133	52	667	0	948	268	605
5	122	65	866	0	468	161	449
6	46	117	525	0	622	313	351
7	40	145	71	0	364	226	575
8	114	120	28	0	322	243	637
9	128	108	14	0	222	200	523
10	137	285	14	0	477	220	541
11	193	114	14	0	649	323	562
12	170	126	0	0	608	285	530
13	109	128	0	0	307	205	433
14	55	93	14	0	87	67	246
15	36	32	0	0	19	56	110
16	24	0	0	0	21	20	47
17	12	5	0	0	0	0	27
18	6	0	0	0	0	0	8
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
Total	1512	1420	11844	42746	7026	3021	7328

NATION - FRANCE GEAR - PS

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	781	886	2569	17184	29813	5891	6543	3037	84	4802	11491
2	7556	2606	33227	3399	25242	69715	47279	101658	45214	6560	52126	119084
3	5851	8385	23098	31797	4805	8569	106921	8763	41795	38978	28065	28670
4	75	200	3556	970	20748	5034	13131	38985	1557	18378	7891	645
5	1410	44	0	456	883	1026	7670	776	422	651	1771	3620
6	4972	232	0	132	36	191	516	1608	24	3	808	1944
7	2590	2465	0	1036	168	97	0	302	514	35	59	107
8	1855	11094	0	2424	888	17	39	68	171	247	127	60
9	9	1724	668	1651	2943	924	1102	196	16	107	88	106
10	31	500	0	4	0	367	288	395	594	69	66	91
11	0	40	0	88	0	17	6	5	107	2	34	81
12	18	0	0	0	0	6	3	0	19	0	1	3
13	0	0	0	0	0	0	3	0	7	38	16	1
14	0	0	0	24	0	0	0	0	0	0	1	3
15	0	0	0	24	0	0	0	0	2	0	0	0
16	0	0	0	0	0	0	0	0	0	3	1	0
17	0	0	0	66	0	0	0	0	0	3	1	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	24366	28071	61434	44640	72897	115774	182848	159296	93477	65157	95859	165904

AGE	1982	1983	1984	1985	1986	1987	1988
1	282666	173907	24377	25110	140667	102814	240811
2	77001	54974	161382	110992	54531	162504	46167
3	80094	38325	2814	150669	34270	41694	103440
4	5362	7301	7942	8369	36530	12977	12648
5	503	4867	3187	3003	1677	1112	2502
6	68	197	1467	857	748	1054	2209
7	191	2623	1486	6	105	880	992
8	33	375	934	0	11	91	585
9	8	195	353	0	0	84	2325
10	19	1497	535	2	0	1244	1260
11	105	98	38	2	0	12	303
12	52	0	1581	0	0	0	0
13	0	0	303	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	446102	284357	206397	299008	268538	324465	413241

NATION - FRANCE GEAR - OTHR

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0	0	0	0	0	0

AGE	1982	1983	1984	1985	1986	1987	1988
1	4130	2900	194	140	1220	718	1257
2	1126	916	1282	617	473	1134	242
3	1164	639	22	838	298	292	540
4	76	123	63	47	318	91	66
5	4	81	26	17	15	8	13
6	0	3	12	5	7	8	12
7	0	44	12	0	1	6	5
8	0	6	7	0	0	1	3
9	0	3	3	0	0	1	12
10	0	25	4	0	0	9	6
11	0	2	0	0	0	0	2
12	0	0	13	0	0	0	0
13	0	0	2	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	6500	4741	1640	1663	2332	2266	2160

NATION = GREECE GEAR = OTHER														
NUMBER CAUGHT														
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981		
1	0	0	0	0	0	0	0	0	0	0	0	0		
2	0	0	0	0	0	0	0	0	0	0	0	0		
3	0	0	0	0	0	0	0	0	0	0	0	0		
4	0	0	0	0	0	0	0	0	0	0	0	0		
5	0	0	0	0	0	0	0	0	0	0	0	0		
6	0	0	0	0	0	0	0	0	0	0	0	0		
7	0	0	0	0	0	0	0	0	0	0	0	0		
8	0	0	0	0	0	0	0	0	0	0	0	0		
9	0	0	0	0	0	0	0	0	0	0	0	0		
10	0	0	0	0	0	0	0	0	0	0	0	0		
11	0	0	0	0	0	0	0	0	0	0	0	0		
12	0	0	0	0	0	0	0	0	0	0	0	0		
13	0	0	0	0	0	0	0	0	0	0	0	0		
14	0	0	0	0	0	0	0	0	0	0	0	0		
15	0	0	0	0	0	0	0	0	0	0	0	0		
16	0	0	0	0	0	0	0	0	0	0	0	0		
17	0	0	0	0	0	0	0	0	0	0	0	0		
18	0	0	0	0	0	0	0	0	0	0	0	0		
19	0	0	0	0	0	0	0	0	0	0	0	0		
20	0	0	0	0	0	0	0	0	0	0	0	0		
total	0	0	0	0	0	0	0	0	0	0	0	0		

AGE	1982	1983	1984	1985	1986	1987	1988		
1	0	0	0	0	0	0	0		
2	0	0	0	0	0	0	0		
3	0	0	0	0	0	0	0		
4	0	0	0	0	0	0	0		
5	0	0	0	0	0	0	0		
6	0	0	0	0	0	0	0		
7	0	0	0	0	0	0	0		
8	0	0	0	9	9	6	6		
9	0	0	0	52	52	59	59		
10	0	0	0	93	93	177	177		
11	0	0	0	101	101	173	173		
12	0	0	0	121	121	85	85		
13	0	0	0	90	90	47	47		
14	0	0	0	47	47	26	26		
15	0	0	0	22	22	3	3		
16	0	0	0	7	7	8	8		
17	0	0	0	3	3	3	3		
18	0	0	0	0	0	0	0		
19	0	0	0	0	0	2	2		
20	0	0	0	0	0	2	2		
total	0	0	0	546	546	592	592		

NATION = ITALY GEAR = LL												
NUMBER CAUGHT												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0	0	0	0	0	0

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	3
2	0	1	0	0	0	44	31
3	0	3	83	18	1	23	124
4	0	5	132	81	1	42	56
5	0	8	90	83	0	24	43
6	0	11	20	30	0	48	34
7	0	18	11	13	0	35	55
8	0	13	7	11	1	37	59
9	0	13	13	12	0	31	50
10	0	32	23	33	0	34	51
11	0	10	33	44	1	49	53
12	0	16	32	53	1	43	49
13	0	16	30	34	0	31	40
14	0	13	19	14	0	10	23
15	0	3	11	9	0	9	11
16	0	1	5	4	0	3	5
17	0	1	5	2	0	0	3
18	0	0	2	0	0	0	1
19	0	0	1	0	0	0	0
20	0	0	1	0	0	0	0
total	0	164	517	440	5	463	689

NATION = ITALY-ADRIATIC GEAR = PSFS

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	155	0	0	0	503	1964	0	0	0	0
2	0	1885	2804	4142	0	0	14973	2470	1554	4972	12430	12430
3	0	13883	2843	2473	0	0	16605	515	3792	12133	30334	30334
4	0	1837	494	409	0	0	4163	287	1100	3519	8799	8799
5	0	185	0	55	0	0	45	0	3	10	26	26
6	0	0	0	58	0	0	35	0	8	26	64	64
7	0	0	0	54	0	0	33	0	8	24	60	60
8	0	0	0	47	0	0	29	0	7	21	52	52
9	0	0	0	23	0	0	14	0	3	10	26	26
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	34791	6294	7260	0	0	36400	5236	6474	20716	51791	51791

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	91455	119538	112256	55897	129888
2	12425	12425	86141	2344	43517	88350	24902
3	30330	30330	2797	0	12687	9298	26777
4	8813	8813	0	0	0	0	0
5	28	28	0	0	0	0	0
6	80	80	0	0	0	0	0
7	75	75	0	0	0	0	0
8	65	65	0	0	0	0	0
9	33	33	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	51848	51848	180394	121882	168461	153545	181566

NATION = ITALY-TYRRHENIAN GEAR = GILL												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0	0	0	0	0	0

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0
2	0	0	0	1	0	0	0
3	0	0	201	28	1	0	0
4	0	0	321	131	15	0	0
5	0	0	219	134	24	0	0
6	0	0	49	48	23	0	0
7	0	0	26	20	17	0	0
8	0	0	18	18	9	0	0
9	0	0	31	20	11	0	0
10	0	0	56	54	14	0	0
11	0	0	81	70	27	0	0
12	0	0	79	86	39	0	0
13	0	0	72	56	30	0	0
14	0	0	47	22	18	0	0
15	0	0	27	14	9	0	0
16	0	0	12	6	3	0	0
17	0	0	12	3	1	0	0
18	0	0	5	0	0	0	0
19	0	0	2	1	1	0	0
20	0	0	2	0	0	0	0
total	0	0	1261	710	240	0	0

NATION - ITALY-TYRR. GEAR - TRAP												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	2	89
4	228	11	33	15	30	74	25	10	0	0	9	138
5	114	30	128	56	113	304	113	58	0	0	15	104
6	114	116	204	90	181	384	311	318	17	0	22	60
7	114	476	377	166	333	314	322	359	49	0	14	97
8	114	300	270	119	239	288	133	93	52	0	26	111
9	1162	324	286	126	253	295	91	28	50	6	30	120
10	1686	211	185	81	164	189	89	63	73	76	73	120
11	1025	247	211	93	187	205	157	157	63	63	70	155
12	570	212	281	124	249	452	277	246	64	57	80	119
13	114	499	450	198	399	481	314	289	86	135	91	74
14	114	794	569	250	504	363	352	387	111	103	81	49
15	0	564	389	171	344	215	277	328	104	70	61	37
16	0	240	168	73	148	96	150	185	44	78	40	20
17	0	144	89	39	79	26	99	135	29	40	12	11
18	0	72	40	17	35	0	71	104	46	30	2	10
19	0	6	3	1	3	0	16	23	14	4	1	3
20	0	0	2	1	2	6	34	48	0	0	0	3
total	5355	4245	3686	1619	3262	3691	2829	2831	801	660	629	1319

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	2538	2177	0	20
2	0	8	0	0	10868	0	5
3	104	23	0	0	524	48	0
4	68	44	0	0	0	538	0
5	80	78	9	23	0	538	3
6	46	102	18	110	12	265	45
7	24	179	62	32	46	135	42
8	56	132	155	60	35	116	48
9	79	131	365	107	67	144	65
10	93	316	424	279	115	149	93
11	105	99	310	245	232	176	198
12	114	154	237	219	320	180	235
13	75	163	83	186	248	128	318
14	47	127	50	76	126	78	198
15	26	31	8	45	79	55	121
16	15	7	2	20	37	7	39
17	8	5	0	9	14	2	15
18	4	0	0	6	9	0	6
19	0	0	0	0	5	0	1
20	0	0	0	3	4	0	1
total	944	1598	1723	3956	14918	2561	1453

NATION = ITALY-TYRR. GEAR = OTHER												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	381	0	116	339	339	339	339	339	301	0	0	0
2	715	0	235	19	19	19	19	19	16	0	0	0
3	170	0	262	31	31	31	31	31	29	0	0	36
4	381	16	309	42	42	46	42	41	35	195	0	133
5	245	20	93	20	20	35	23	19	10	780	0	350
6	7	6	14	14	14	30	33	41	6	0	0	23
7	7	26	25	25	25	25	34	46	17	0	0	38
8	7	16	18	18	18	23	14	12	18	0	0	44
9	68	17	19	19	19	23	9	4	17	2	0	47
10	98	12	12	12	12	15	9	9	25	26	0	48
11	60	13	14	14	14	16	17	20	21	22	0	61
12	33	11	19	19	19	35	29	32	22	20	0	47
13	7	27	30	30	30	38	33	37	29	46	0	29
14	7	43	38	38	38	29	37	50	38	36	0	20
15	0	30	26	26	26	17	29	42	35	24	0	15
16	0	13	11	11	11	8	16	24	15	27	0	8
17	0	8	6	6	6	2	10	17	10	14	0	4
18	0	4	3	3	3	0	7	13	16	10	0	4
19	0	0	0	0	0	0	2	3	5	1	0	1
20	0	0	0	0	0	1	3	7	0	0	0	1
total	2186	261	1250	686	686	732	736	807	662	1201	0	910

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	8239	7809	9433	7954
2	0	0	0	5339	1209	5322	343
3	40	0	2561	399	1140	1142	748
4	24	0	4084	376	1871	1873	1369
5	36	4	2778	351	688	2583	872
6	12	13	633	882	787	1565	1292
7	4	13	342	592	515	3823	3336
8	20	51	254	894	636	1159	376
9	29	80	429	924	1008	357	75
10	36	295	741	1326	913	505	442
11	43	220	1043	1769	1341	375	747
12	43	194	1012	1018	1566	500	1013
13	29	50	921	979	1698	100	270
14	17	46	598	783	998	23	141
15	12	2	353	405	306	114	21
16	5	4	158	131	236	0	7
17	2	0	145	83	83	0	3
18	0	0	54	103	28	0	1
19	0	4	24	13	0	114	107
20	0	0	31	0	70	228	321
total	352	976	16159	24601	22901	29216	19439

NATION = ITALY-LIG. GEAR = PSFS												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	1278	2317	25643	36647	7080	2360	4472	23	4966	13872
2	0	0	47923	3066	37668	85697	56823	36669	66585	1821	53908	143763
3	0	0	33313	28684	7171	10533	128504	3161	61549	10818	29024	34612
4	0	0	5128	875	30962	6188	15782	14062	2292	5101	8162	778
5	0	0	0	412	1318	1261	9218	280	622	181	1832	4371
6	0	0	0	119	54	235	620	580	35	1	835	2347
7	0	0	0	935	251	119	0	109	757	10	61	129
8	0	0	0	2187	1325	21	47	24	252	68	132	73
9	0	0	963	1489	4392	1136	1325	71	24	30	91	128
10	0	0	0	4	0	451	346	142	874	19	68	109
11	0	0	0	79	0	21	7	2	157	1	35	97
12	0	0	0	0	0	8	4	0	28	0	1	4
13	0	0	0	0	0	0	4	0	10	11	17	1
14	0	0	0	22	0	0	0	0	0	0	1	4
15	0	0	0	22	0	0	0	0	3	0	0	0
16	0	0	0	0	0	0	0	0	0	1	1	0
17	0	0	0	60	0	0	0	0	0	1	1	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	88605	40269	108782	142315	219759	57461	137660	18085	99136	200286

AGE	1982	1983	1984	1985	1986	1987	1988
1	224689	96228	6410	10830	89726	12481	16543
2	61212	30419	42434	47871	34783	19727	3172
3	63670	21207	740	64983	21859	5061	7106
4	4265	4040	2088	3610	23301	1576	870
5	400	2693	838	1295	1070	135	172
6	54	109	386	370	477	128	152
7	152	1451	391	3	67	106	68
8	28	208	246	0	7	11	40
9	6	108	93	0	0	10	159
10	17	828	141	1	0	151	87
11	85	54	10	1	0	2	21
12	42	0	416	0	0	0	0
13	0	0	80	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	354620	157346	54271	128963	171290	39388	28390

NATION = ITALY-TYRR. GEAR = PSFB

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	285	10	41	49	125	431	157	61	0	0	36	733
5	143	24	156	187	476	1781	715	345	0	0	205	1136
6	143	93	249	299	762	2250	1970	1905	174	0	482	489
7	143	383	460	553	1407	1837	2148	2148	491	0	312	792
8	143	241	330	397	1010	1687	843	554	516	0	580	906
9	1455	261	349	420	1070	1725	573	169	498	81	670	980
10	2111	169	226	271	691	1106	564	379	734	1110	1616	980
11	1284	199	258	310	788	1200	995	939	634	920	1554	1267
12	713	170	344	413	1051	2643	1759	1473	634	839	1768	971
13	143	402	550	661	1683	2812	1988	1729	858	1975	1728	608
14	143	639	696	835	2128	2118	2234	2317	1113	1516	1785	400
15	0	454	475	571	1453	1256	1754	1966	1039	1029	1339	304
16	0	193	204	246	626	562	951	1108	435	1137	893	165
17	0	116	109	130	332	150	627	811	286	595	268	91
18	0	58	49	58	148	0	451	621	460	433	54	80
19	0	5	4	5	12	0	98	135	137	54	18	28
20	0	0	3	3	9	37	216	284	0	0	0	28
total	6704	3416	4501	5406	13771	21596	17931	16943	8011	9689	13928	10809

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0
2	12	71	0	8	0	0	0
3	1442	206	4993	406	8	87	48
4	992	398	7961	1896	346	966	416
5	1152	706	5416	1938	582	968	395
6	606	918	1224	691	556	476	184
7	363	1617	643	293	409	243	154
8	773	1187	458	264	213	208	115
9	1094	1187	784	289	272	259	97
10	1307	2852	1391	779	332	268	142
11	1491	889	1999	1017	641	315	172
12	1581	1392	1955	1243	937	323	221
13	1067	1470	1788	808	718	231	140
14	648	1145	1163	322	433	141	94
15	352	276	687	201	208	100	79
16	220	67	308	84	67	12	22
17	122	45	282	38	34	4	11
18	64	0	106	4	12	6	6
19	10	0	44	8	11	0	8
20	20	0	62	0	4	0	15
total	13316	14426	31261	10289	5783	4600	2317

NATION = JAPAN GEAR = LL

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	29	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	2	0
4	0	0	4	5	65	53	48	0	0	35	4	0
5	0	0	1	5	48	8	199	4	0	0	6	2
6	0	0	5	10	112	61	206	45	0	35	12	11
7	0	0	5	8	89	57	172	151	0	105	13	24
8	0	0	47	80	902	550	218	463	64	172	90	79
9	0	0	49	93	1012	546	183	420	7	69	234	51
10	0	0	117	229	2490	1315	521	462	0	0	75	75
11	0	0	85	138	1571	1020	790	302	0	0	70	107
12	0	0	119	209	2333	1376	535	125	136	0	64	69
13	0	0	103	214	2288	1132	452	202	7	0	40	34
14	0	0	50	126	1285	492	331	393	72	0	16	25
15	0	0	11	26	269	118	187	126	0	0	4	14
16	0	0	14	29	305	155	282	51	0	0	2	9
17	0	0	3	5	56	30	83	13	72	0	6	2
18	0	0	0	0	0	0	20	0	0	0	2	2
19	0	0	0	0	0	0	7	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	1
total	0	0	615	1178	12826	6912	4263	2758	358	416	641	503

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	3	0	6	0	0	0
2	0	26	0	53	0	0	0
3	36	53	39	133	11	11	10
4	201	128	91	119	62	14	12
5	79	193	200	152	46	14	12
6	432	291	141	185	46	22	19
7	430	436	148	497	44	62	52
8	254	337	459	363	90	73	61
9	162	322	1038	469	178	163	137
10	258	811	1102	602	339	202	170
11	253	284	1052	727	372	227	191
12	114	379	719	954	363	278	234
13	492	394	482	755	284	297	250
14	597	296	266	350	121	247	208
15	260	84	100	184	31	152	127
16	387	11	200	108	15	50	43
17	381	13	60	144	18	17	14
18	273	0	27	52	3	0	0
19	138	0	12	33	1	0	0
20	61	0	8	50	2	0	0
total	4810	4059	6141	5933	2023	1828	1539

NATION = LYBIA GEAR = OTHR

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	119	17	12	16	20	66	31	5	0	0	4	116
5	59	59	46	61	77	271	139	28	0	0	24	180
6	59	67	73	98	122	342	382	153	56	0	57	77
7	59	274	135	180	226	280	396	173	158	0	37	125
8	59	172	97	130	162	257	164	45	166	0	69	143
9	605	187	103	137	171	263	112	13	160	12	79	155
10	878	121	67	89	111	168	110	30	236	165	191	155
11	534	142	76	101	126	183	193	76	205	137	184	201
12	296	121	101	135	169	402	341	118	204	125	209	154
13	59	287	162	216	270	428	386	139	277	293	239	96
14	59	457	204	273	341	322	434	186	359	225	212	63
15	0	324	140	186	233	191	340	158	335	153	159	48
16	0	138	60	80	100	86	185	89	140	169	106	26
17	0	83	32	43	53	23	122	65	92	88	32	14
18	0	42	14	19	24	0	88	50	148	64	7	13
19	0	3	1	2	2	0	19	11	44	8	2	4
20	0	0	1	1	1	6	42	23	0	0	0	4
total	2787	2441	1324	1766	2208	3287	3482	1362	2581	1439	1650	1709

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	2580	2229	0	20
2	2	8	0	0	11129	0	5
3	206	25	0	0	536	47	0
4	138	47	0	0	0	520	0
5	162	83	9	23	0	521	3
6	86	108	17	113	12	256	45
7	52	190	57	33	47	131	42
8	108	139	142	61	36	112	48
9	155	139	335	109	69	139	65
10	186	334	389	284	118	144	93
11	213	104	284	248	238	170	197
12	225	163	217	222	329	174	234
13	151	173	77	188	255	124	317
14	91	134	46	77	130	76	198
15	49	32	7	46	82	54	121
16	30	8	2	20	39	6	39
17	16	5	0	9	14	2	15
18	8	0	0	6	9	0	6
19	2	0	0	0	5	0	1
20	2	0	0	3	4	0	1
total	1882	1694	1581	4024	15278	2477	1449

NATION - MOROCCO GEAR = PS												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0	0	0	0	0	0

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0

NATION = MORROCCO GEAR = TRAP												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	2	0	0	0	0	0	0	0	0	0
2	0	0	4	0	0	0	0	0	0	0	0	0
3	0	0	5	0	1	0	0	0	0	0	0	0
4	0	0	5	0	1	0	0	0	0	0	0	0
5	0	0	3	0	1	0	0	0	0	0	0	0
6	0	12	9	0	3	0	0	0	0	0	0	0
7	0	8	6	0	3	0	0	0	0	0	0	0
8	0	17	15	0	3	0	0	0	0	0	0	0
9	0	31	31	0	6	0	0	0	0	0	0	0
10	0	28	26	0	4	0	0	0	0	0	0	0
11	0	22	22	0	4	0	0	0	0	0	0	0
12	0	27	28	3	5	0	0	0	0	0	0	0
13	0	21	21	2	4	0	0	0	0	0	0	0
14	0	13	12	0	2	0	0	0	0	0	0	0
15	0	6	4	0	2	0	0	0	0	0	0	0
16	0	3	1	0	1	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	186	194	4	40	0	0	0	0	0	0	0

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	16
4	0	0	0	0	0	0	16
5	0	0	0	0	0	12	42
6	0	0	0	0	0	103	122
7	0	0	0	0	0	205	166
8	0	0	0	0	0	250	116
9	0	0	0	0	0	288	59
10	0	0	0	0	0	227	44
11	0	0	0	0	0	291	38
12	0	0	0	0	0	265	26
13	0	0	0	0	0	230	12
14	0	0	0	0	0	102	3
15	0	0	0	0	0	79	4
16	0	0	0	0	0	28	3
17	0	0	0	0	0	10	0
18	0	0	0	0	0	1	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	0	0	0	0	0	2091	668

NATION = MORROCCO GEAR = OTHER												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0	0	0	0	0	0

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	192	1935	225	0	9018
2	0	0	180	38	0	0	0
3	0	0	6	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	0	0	378	1973	226	0	9018

NATION = SPAIN GEAR = LL												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	2	0	8	11	8	4	401	0	0	0	0	0
2	4	0	17	19	13	7	100	5	0	22	8	0
3	1	0	18	31	22	11	361	6	19	18	28	67
4	2	2	21	38	27	14	1386	31	84	56	40	4
5	3	5	9	19	13	7	683	32	70	61	82	78
6	15	35	31	68	49	25	361	28	80	49	46	115
7	47	25	24	56	39	21	180	43	97	129	42	129
8	74	53	49	108	76	41	321	41	82	197	61	190
9	51	112	106	234	164	88	121	41	30	94	84	305
10	44	96	91	201	141	76	100	40	51	78	100	111
11	36	77	75	165	115	63	100	35	36	57	66	257
12	45	97	94	205	143	78	0	92	44	16	43	75
13	37	75	73	160	112	60	0	8	15	0	14	0
14	21	45	42	95	67	35	0	18	21	16	32	0
15	7	15	14	32	24	13	0	2	27	2	6	0
16	2	6	5	11	8	4	0	0	10	6	3	0
17	0	1	0	2	1	1	0	0	0	0	5	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	391	644	679	1454	1021	548	4115	420	667	771	658	1331

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	18	17	148	31	0	7
2	40	128	87	773	116	78	65
3	160	179	54	795	247	42	267
4	88	94	33	304	196	73	123
5	136	144	31	181	97	43	90
6	432	82	49	124	129	85	71
7	384	138	36	79	75	62	116
8	328	205	43	47	67	67	129
9	592	228	59	37	46	55	105
10	640	219	51	59	99	61	109
11	264	173	42	56	134	89	113
12	472	99	36	36	126	78	106
13	264	44	23	17	64	56	87
14	0	32	8	15	18	19	49
15	40	6	8	11	4	16	22
16	32	5	7	8	4	5	10
17	48	3	2	0	0	0	6
18	0	0	0	0	0	0	2
19	0	5	0	0	0	0	0
20	0	0	0	0	0	0	0
total	3920	1803	586	2691	1453	828	1477

NATION = SPAIN GEAR = PS												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	256
2	0	0	0	0	0	0	0	0	0	0	0	2344
3	0	0	0	0	0	0	0	0	0	0	0	648
4	0	0	0	0	0	0	0	0	0	0	0	12
5	0	0	0	0	0	0	0	0	0	0	0	91
6	0	0	0	0	0	0	0	0	0	0	0	21
7	0	0	0	0	0	0	0	0	0	0	0	5
8	0	0	0	0	0	0	0	0	0	0	0	3
9	0	0	0	0	0	0	0	0	0	0	0	2
10	0	0	0	0	0	0	0	0	0	0	0	2
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0	0	0	0	0	3384

AGE	1982	1983	1984	1985	1986	1987	1988
1	6696	0	510	0	276	0	0
2	8926	0	3376	0	0	0	0
3	6842	0	59	166	0	0	0
4	803	0	167	1740	0	0	0
5	28	0	67	0	0	0	0
6	0	0	31	0	0	0	0
7	0	0	31	0	0	0	0
8	0	0	20	0	0	0	0
9	0	0	8	0	0	0	0
10	0	0	11	0	0	0	0
11	0	0	1	0	0	0	0
12	0	0	33	0	0	0	0
13	0	0	6	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	23295	0	4321	1906	276	0	0

NATION = SPAIN GEAR = GILL												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0	0	0	0	0	0

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	645	322	0	0	0
2	0	0	0	6	0	0	0
3	0	0	0	0	0	0	0
4	0	0	3	0	0	0	0
5	0	0	1	0	0	0	0
6	0	0	2	0	0	0	0
7	0	0	1	0	0	0	0
8	0	0	1	0	0	0	0
9	0	0	1	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	1	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	0	0	654	329	0	0	0

NATION = SPAIN GEAR = TRAP												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	8	0	6	151	0	0	0	0	0	0	0	0
2	16	0	12	9	0	0	0	0	0	0	0	0
3	3	0	13	14	1	0	0	0	0	0	0	0
4	8	1	16	18	1	0	0	0	0	0	0	0
5	12	3	6	9	1	0	0	0	0	0	0	0
6	61	14	21	32	3	0	0	0	0	0	0	1
7	190	10	17	26	3	0	0	0	0	0	0	4
8	302	20	33	51	4	2	2	0	0	0	0	3
9	206	43	74	109	9	3	3	2	0	0	0	3
10	177	37	64	94	6	3	3	2	0	0	0	3
11	145	30	52	77	5	2	2	2	1	0	0	2
12	183	37	66	95	6	2	2	2	1	0	0	2
13	149	29	51	75	5	2	2	2	1	0	0	0
14	83	17	30	45	3	2	2	1	0	0	0	0
15	28	6	10	15	2	0	0	0	0	0	0	0
16	8	2	3	5	1	0	0	0	0	0	0	0
17	2	1	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	1577	252	477	825	51	16	16	11	3	0	0	18

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	2244	0	0
2	0	0	0	0	11199	0	0
3	0	0	0	75	540	0	37
4	4	0	63	545	0	0	39
5	16	1	63	167	0	8	99
6	40	2	42	313	2	67	290
7	105	2	126	330	8	133	395
8	105	9	168	244	3	163	276
9	90	15	378	202	2	187	140
10	86	54	483	211	18	147	103
11	50	40	441	237	41	189	91
12	57	36	462	162	48	172	62
13	11	9	105	91	26	149	30
14	12	9	168	45	12	66	7
15	4	0	63	23	11	51	8
16	6	1	63	5	7	18	7
17	4	0	105	8	7	6	0
18	0	0	42	4	1	1	0
19	0	1	42	0	0	0	0
20	0	0	0	0	0	0	0
total	590	181	2815	2662	14168	1359	1584

NATION = SPAIN GEAR = OTHR												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	3877
2	0	0	0	0	0	0	0	0	0	0	0	3421
3	0	0	0	0	0	0	0	0	0	0	0	1523
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	1	0	0	0	0	0	0
6	0	0	0	0	0	3	0	0	0	0	0	0
7	0	0	0	0	0	4	0	0	0	0	0	0
8	0	0	0	0	0	24	0	0	0	0	0	0
9	0	0	0	0	0	33	0	0	0	0	0	0
10	0	0	0	0	0	25	0	0	0	0	0	0
11	0	0	0	0	0	2	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	91	0	0	0	0	0	8820

AGE	1982	1983	1984	1985	1986	1987	1988
1	1648	0	36664	62022	2758	0	0
2	2081	0	29274	949	0	0	0
3	936	0	4091	0	0	0	0
4	0	0	4506	9	2	0	36
5	0	3	5827	102	36	239	224
6	0	10	3588	283	54	768	1158
7	0	10	582	307	30	750	1580
8	0	38	390	430	29	555	891
9	0	60	367	448	24	539	846
10	0	222	390	303	17	598	544
11	0	166	312	100	28	517	388
12	0	147	124	46	10	222	161
13	0	38	74	5	1	45	39
14	0	35	133	6	3	0	4
15	0	2	19	0	0	0	0
16	0	3	8	0	0	0	4
17	0	0	5	0	0	0	0
18	0	0	2	0	0	0	0
19	0	3	7	0	0	0	0
20	0	0	0	0	0	0	0
total	4665	738	86364	65009	2994	4232	5874

NATION - TUNISIA GEAR - PS												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0	0	0	0	0	0

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	5026
2	0	0	0	0	0	0	963
3	0	0	0	0	0	0	2158
4	0	0	0	0	0	0	264
5	0	0	0	0	0	0	52
6	0	0	0	0	0	0	46
7	0	0	0	0	0	0	21
8	0	0	0	0	0	0	12
9	0	0	0	0	0	0	48
10	0	0	0	0	0	0	26
11	0	0	0	0	0	0	6
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	0	0	0	0	0	0	8623

NATION = TUNISIA GEAR = TRAP

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	1	21
4	49	1	1	1	2	6	1	1	0	6	4	33
5	25	4	5	3	7	26	5	5	0	91	6	24
6	25	15	8	5	11	32	14	27	5	66	8	14
7	25	61	15	8	20	27	15	30	14	104	6	23
8	25	38	11	6	14	24	7	8	15	69	10	26
9	250	42	11	6	15	25	4	3	14	47	12	28
10	363	27	7	4	10	16	4	6	21	22	29	28
11	221	31	8	5	11	17	7	14	18	39	28	36
12	123	27	11	6	15	38	13	21	18	23	32	28
13	25	64	13	10	24	41	14	25	25	19	36	18
14	25	102	22	12	31	31	16	33	32	13	32	12
15	0	72	15	8	21	18	13	28	30	4	24	9
16	0	31	7	3	9	8	7	16	12	1	16	5
17	0	19	4	2	5	2	5	12	8	0	5	3
18	0	10	2	1	2	0	3	9	13	0	1	2
19	0	1	0	0	0	0	1	2	4	0	0	1
20	0	0	0	0	0	1	2	4	0	0	0	1
total	1153	544	145	80	199	311	130	244	229	504	249	310

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	688	624	0	6
2	0	2	0	0	3115	0	1
3	66	6	0	0	150	13	0
4	44	12	0	0	0	144	0
5	52	22	3	6	0	144	0
6	28	29	5	30	4	71	12
7	19	50	16	9	13	36	12
8	33	37	37	17	10	31	12
9	52	37	90	29	19	39	19
10	59	89	103	75	33	40	26
11	69	28	75	66	67	47	55
12	74	44	57	59	92	48	65
13	48	46	20	50	71	35	88
14	32	36	12	20	36	21	54
15	15	9	2	12	22	15	33
16	10	2	1	5	11	2	11
17	6	1	0	3	4	1	4
18	2	0	0	2	3	0	1
19	0	0	0	0	1	0	0
20	0	0	0	1	1	0	1
total	608	450	421	1071	4275	685	400

NATION = TURKEY GEAR = PS

AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0	0	0	0	0	0

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	63149	37645	37645
4	0	0	0	0	6736	4015	4015
5	0	0	0	0	1684	1004	1004
6	0	0	0	0	842	502	502
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	0	0	0	0	72411	43166	43166

NATION = TURKEY GEAR = OTHER												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	4	242
4	33	0	3	2	1	2	0	3	0	0	24	375
5	16	0	11	10	5	7	0	15	0	0	38	281
6	16	3	16	16	9	10	0	81	11	0	56	161
7	16	10	31	30	15	7	0	91	30	0	36	262
8	16	6	22	21	11	7	0	23	31	0	68	299
9	167	7	23	23	12	7	24	7	30	1	78	323
10	242	5	15	15	8	5	108	16	44	11	188	323
11	147	5	17	17	9	5	149	40	38	9	181	418
12	82	5	23	22	11	11	119	63	38	8	206	320
13	16	11	37	36	18	12	161	73	52	19	235	201
14	16	17	46	45	23	9	86	98	67	14	208	132
15	0	12	32	31	16	5	48	83	63	10	156	100
16	0	5	14	13	7	2	20	47	26	11	104	54
17	0	3	7	7	4	1	4	34	17	6	31	30
18	0	1	3	3	2	0	0	26	28	4	6	26
19	0	0	0	0	0	0	0	6	9	1	2	9
20	0	0	0	0	0	0	0	12	0	0	0	9
total	769	88	300	292	151	89	718	719	486	92	1620	3567

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	210	2564	0	0	0
2	6	15	1085	13362	0	0	0
3	546	45	672	13764	0	0	0
4	375	87	413	5245	0	0	0
5	437	154	378	3139	0	0	0
6	230	200	609	2162	0	0	0
7	137	352	441	1378	0	0	0
8	295	258	525	822	0	0	0
9	414	258	735	650	0	0	0
10	494	620	637	1014	0	0	0
11	562	193	518	976	0	0	0
12	598	303	455	632	0	0	0
13	404	320	280	287	0	0	0
14	244	249	98	268	0	0	0
15	135	60	98	191	0	0	0
16	83	15	91	134	0	0	0
17	46	10	21	0	0	0	0
18	25	0	0	0	0	0	0
19	5	0	0	0	0	0	0
20	10	0	0	0	0	0	0
total	5046	3139	7266	46588	0	0	0

NATION = YUGOSLAVIA GEAR = PS													
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	
1	781	0	327	0	135	65	473	38966	0	0	0	0	
2	1465	12413	5904	7931	9572	4680	14094	48971	13038	9396	7122	4648	
3	348	9126	5985	4733	7767	3797	15632	10199	31820	22933	17381	11345	
4	753	1208	1039	784	1665	814	3918	5685	9230	6652	5042	3291	
5	488	122	0	104	85	42	42	0	27	20	15	10	
6	0	0	0	110	86	42	32	0	69	50	38	24	
7	0	0	0	104	81	39	30	0	64	47	36	23	
8	0	0	0	90	70	34	26	0	56	40	31	20	
9	0	0	0	44	35	17	13	0	28	20	15	10	
10	0	0	0	0	0	0	0	0	0	0	0	0	
11	0	0	0	0	0	0	0	0	0	0	0	0	
12	0	0	0	0	0	0	0	0	0	0	0	0	
13	0	0	0	0	0	0	0	0	0	0	0	0	
14	0	0	0	0	0	0	0	0	0	0	0	0	
15	0	0	0	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	0	0	0	
total	3836	22868	13255	13900	19496	9529	34261	103821	54333	39158	29681	19369	

NATION = YUGOSLAVIA GEAR = PS													
AGE	1982	1983	1984	1985	1986	1987	1988						
1	0	0	39424	163154	59676	23887	130927						
2	6040	15134	37133	3199	23134	37754	25100						
3	14742	36942	1206	0	6744	3973	26991						
4	4273	10735	0	0	0	0	0						
5	12	34	0	0	0	0	0						
6	32	98	0	0	0	0	0						
7	30	91	0	0	0	0	0						
8	26	79	0	0	0	0	0						
9	13	40	0	0	0	0	0						
10	0	0	0	0	0	0	0						
11	0	0	0	0	0	0	0						
12	0	0	0	0	0	0	0						
13	0	0	0	0	0	0	0						
14	0	0	0	0	0	0	0						
15	0	0	0	0	0	0	0						
16	0	0	0	0	0	0	0						
17	0	0	0	0	0	0	0						
18	0	0	0	0	0	0	0						
19	0	0	0	0	0	0	0						
20	0	0	0	0	0	0	0						
total	25167	63152	77762	166353	89554	65614	183018						

NATION = OTHER GEAR = LL												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	1	0	0	0	0
8	0	0	0	0	0	0	0	4	0	0	0	0
9	0	0	0	0	0	0	0	3	0	0	0	0
10	0	0	0	0	0	0	0	4	0	0	0	0
11	0	0	0	0	0	0	0	3	0	0	0	0
12	0	0	0	0	0	0	0	1	0	0	0	0
13	0	0	0	0	0	0	0	3	0	0	0	0
14	0	0	0	0	0	0	0	1	0	0	0	0
15	0	0	0	0	0	0	0	1	0	0	0	0
16	0	0	0	0	0	0	0	1	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0	22	0	0	0	0

AGE	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
total	0	0	0	0	0	0	0

NATION = OTHER GEAR = TRAP													
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	
1	356	0	82	264	604	318	271	464	464	0	0	0	
2	668	0	166	15	34	19	15	25	25	0	0	0	
3	159	0	185	25	56	30	26	43	43	0	0	0	
4	343	38	216	31	72	38	32	55	55	243	221	180	
5	223	43	60	9	20	11	9	15	15	972	884	722	
6	0	0	0	0	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	0	0	0	0	
10	0	0	0	0	0	0	0	0	0	0	0	0	
11	0	0	0	0	0	0	0	0	0	0	0	0	
12	0	0	0	0	0	0	0	0	0	0	0	0	
13	0	0	0	0	0	0	0	0	0	0	0	0	
14	0	0	0	0	0	0	0	0	0	0	0	0	
15	0	0	0	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	0	0	0	
total	1750	81	709	343	786	415	353	603	603	1215	1105	902	

NATION = OTHER GEAR = TRAP													
AGE	1982	1983	1984	1985	1986	1987	1988						
1	0	0	0	0	0	0	0						
2	0	0	0	0	0	0	0						
3	0	0	0	0	0	0	0						
4	0	0	0	0	0	0	0						
5	0	0	0	0	0	0	0						
6	0	0	0	0	0	0	0						
7	0	0	0	0	0	0	0						
8	0	0	0	0	0	0	0						
9	0	0	0	0	0	0	0						
10	0	0	0	0	0	0	0						
11	0	0	0	0	0	0	0						
12	0	0	0	0	0	0	0						
13	0	0	0	0	0	0	0						
14	0	0	0	0	0	0	0						
15	0	0	0	0	0	0	0						
16	0	0	0	0	0	0	0						
17	0	0	0	0	0	0	0						
18	0	0	0	0	0	0	0						
19	0	0	0	0	0	0	0						
20	0	0	0	0	0	0	0						
total	0	0	0	0	0	0	0						

NATION = OTHER GEAR = OTHER												
AGE	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0	0	0	0	163	287	194	364	201	0	0	0
2	0	0	0	0	9	15	10	20	11	0	0	0
3	0	0	0	0	15	26	18	34	19	0	0	0
4	0	0	0	0	20	34	23	43	24	85	88	118
5	0	0	0	0	5	9	6	12	7	339	354	471
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
total	0	0	0	0	211	371	251	473	262	424	442	589

NATION = OTHER GEAR = OTHER												
AGE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0	2	5	25	10	0	1					
2	0	17	27	126	41	24	13					
3	24	24	17	130	86	13	49					
4	18	13	10	49	69	24	22					
5	22	20	10	29	34	14	17					
6	10	11	15	20	45	27	13					
7	5	19	11	13	27	20	22					
8	13	28	13	8	23	20	24					
9	20	31	18	6	16	17	20					
10	24	30	16	10	34	19	20					
11	28	24	13	9	47	28	21					
12	28	13	11	6	44	24	20					
13	20	6	7	3	22	17	17					
14	9	5	2	3	6	6	9					
15	8	1	2	2	1	5	4					
16	5	1	2	1	2	2	1					
17	2	0	1	0	0	0	1					
18	0	0	0	0	0	0	0					
19	0	1	0	0	0	0	0					
20	0	0	0	0	0	0	0					
total	236	244	180	442	508	258	274					

AGENDA

1. Opening
2. Election of the Co-Chairman
3. Adoption of the Agenda
4. Nomination of rapporteurs
5. Review of working papers
6. Review of national fisheries
7. Review of the data base
 - A. Total national annual catches by gear
 - B. Catch and effort
 - C. Distribution of catch and effort
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 - A. Length-weight relationships
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 - A. Stock-assessment models to be used
 - B. Application of models to the existing data
 - C. Review of results
15. Recommendations
 - A. Statistics
 - B. Research and technology
 - C. Management
16. Future research and work plan
17. Adoption of the report
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THE TUNA FISHERY IN THE EASTERN ADRIATIC

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SUMMARY

The development of tuna fishery in the eastern Adriatic between 1947 and 1989 is presented. Bluefin tuna makes up the largest proportion of the total tuna catch whereas small tuna species (bonito, frigate tuna and little tunny) are caught in small quantities. Between 1947 and 1964 fishing was made by passive (traps) and active techniques (purse seines) and catches showed a decrease trend. From 1965 to date, only purse seines have been used and the catch has significantly increased. Data on the weight of tuna specimens are also given.

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INTRODUCTION

Even though of great significance in commercial fishing, tunas are still poorly studied fish species in the Adriatic Sea. Tuna fishing along the eastern Adriatic coast by traps and fixed nets can be traced back to the sixteenth century. These techniques were applied until about 1964. Modern tuna fishing techniques began to develop in 1929, when the first tuna boat with a purse seine was used (Basioli, 1962).

IDENTIFICATION OF THE FISHERY

Of the tunas, the bluefin tuna (Thunnus thynnus L.) is the most important as to catch quantities; that is, they make up, on the average, 77.3% of the total tuna catch for the 43-year period (Table 1). Small tunas, such as bonito (Sarda sarda Bloch), frigate tuna (Auxis rochei, Risso) and little tunny (Euthynnus (euthynnus) quadripunctatus Geoffrey Saint Hilaire) are caught in smaller quantities.

In the postwar period, tuna fishing developed intensively so that, with great annual variations, it amounted, on the average (43-year series), to the 2.9% of the total national catch. Two periods of this development may be distinguished: The first interval from 1947 to 1964 is characterized by the use of passive techniques (traps and fixed nets) and active fishing by tuna purse seiners with an annual average percentage of 3.4% of the total national catch. During the second interval, from 1965 to date, only purse seiners (active method) has been used. These boats also fish for small pelagic fishes. The proportion of tuna catch in the total marine catch dropped to 1.5%. Tuna purse seiners use nets approximatively 1000 m in length and 120 m in depth.

FISHING GROUNDS

Traditional tuna fishing grounds, particularly those for bluefin tuna, are in the northern part of the eastern Adriatic. Very big catches are taken from the vicinities of Kvarner and Kvarnerić. However, recently, best catches have been made off the islands of Lošinj and Dugi-otok. Bluefin are also caught in

significant quantities around the islands of Jabuka, Vis and Palagruža, as well as in the area of Blitvenica. They are rarely caught from the Pelješac channel (Fig. 1).

Bluefin tuna come from the eastern Mediterranean, moving in a south-north direction. A part of the population entering the Adriatic moves along the eastern coast to the north of the northern Adriatic descending in the opposite direction along the Italian coast. The other part of the population enters the middle of the Adriatic up to the Jabuka Pit moving along the Italian coast southwardly (Sccacini, 1961; Viličić, 1985). Younger fish mainly keep in the open middle Adriatic, prevalently around Jabuka, or the northeastern part of the Jabuka Pit (Basioli, 1962; Morović, 1968; Viličić, 1985; Alegria, 1984).

TUNA FISHING FLEET

The Yugoslav fleet developed considerably in the post-war period; 32 boats were operating in 1958. Owing to a period of poor productivity, this number was reduced so that, in the corresponding period of adaptation, only 14 (± 1) purse seiners remained, fishing alternately for tuna and small pelagic fish. These purse seiners are characterized by a hull length of 18.2 - 26.8 m and a gross registered tonnage (GRT) of 70 - 122 tons, and are equipped with engines of 200 - 400 HP. Half these boats have freezing facilities on board. Boats mainly belong to two principal fishing companies in Split and Zadar. They take about 95% of the total bluefin tuna catch. Catches of small tunas species are made by individual fishermen.

METHODS OF TUNA FISHING WITH PURSE SEINE

Most Yugoslav tuna fishing boats fish at night when over 90% of the catch is taken. Vessels may fish singly, in pairs, or in groups.

According to Viličić (1985) bluefin tuna schools may be detected by purse seiners in a variety of ways: when the fish are "jumping" for food or swimming at the sea surface, or disturb the sundance (by day), or generate phosphorescence (by night); by direct observation from spotter, by the inferred association with schools of dolphins and with floating objects.

When bluefin tuna are in pursuit of food at the sea surface they first force small pelagic fish schools to the surface where they chase them, even jumping out of the sea to catch their prey. If fish find enough food they will keep at the same site for a long time, so that a purse seiner may easily

encircle the school and catch it.

The second method of bluefin tuna fishing is used for fish swimming at the sea surface. If the fish are small, from 5 to 10 kilogrammes, they generate small waves, whereas bigger fish of 30 or more kilogrammes generate bigger waves and their fins are easily visible.

Fishing for bluefin tuna at night, when the tuna may generate intense phosphorescence in the sea water that is visible when there is not moonlight, requires particular experiences and skill.

BLUEFIN TUNA CATCH

Bluefin tuna catch statistics expressed as total fish weight (in kg) at landing includes the data of all boats engaged in tuna fishing. It is a common practice that whole fish are landed immediately after catch. Rarely, gutted fish are also landed.

The trend in the proportion of bluefin in the total tuna catch is upwards and was 94.8% in 1988. The lowest percentage was obtained in 1955 (38.4 %) and lowest catch was made in 1962. Variations in bluefin tuna catch are presented in Figure 2 (annual) and Figure 3 (seasonal).

During the period of mixed (passive and active) fishing methods, 1947-1964, the bluefin tuna catch, with normal fluctuations, dropped from 897 t in 1948 to 271 t in 1964. This period was followed by a period of variable and low catches by 1974, with a mean annual catch of 236 tons.

The 1975-1988 period is characterized by an increase in the catch to the maximum value of 1523 t in 1988. Mean catch was 822 t per year in this period. In 1989, catch dropped to 560 t.

SMALL TUNA SPECIES

The statistics for these catches are not quite reliable. Most of small-tuna catch is realized by individual fishermen, who are not obliged to submit the data to the authorities.

In any case, the catch of small tunas shows a significant decrease throughout the period of observations. Bonito make up, on the average, 11.6% of the total tuna catch, with particularly low catches for the last few years, whereas, in 1955, the catch was 311 t; that is, 35% of the total tuna catch that year. However, a sudden increase in the catch of this species was recorded in 1989.

The catch of frigate tuna varies around 12% of the total tuna catch, with a decreasing trend being particularly pronounced since 1972.

Little tunny is a relatively unimportant species in the catch of small tunas, constituting not more than 2% of the total tuna catch.

Skipjack (Euthynnus (Katsuwonus) pelamis L.) occurs very rarely and for these fish no statistics are accumulated.

TUNA FISHING SEASON

Tuna fishing is seasonal, although the bluefin tuna are caught all year round (Fig. 3). The catch is considerably lower in winter down to quite insignificant amounts, very likely due to tuna migrations and climatic factors, as well as to the fact that purse seiners are engaged in small-pelagic fishing.

The statistics for the 1963-1989 period (Table 2) show that most of the bluefin tuna catch is made during summer. On the average, 52.7% of the total annual catch is obtained in July, August and September and 28.5% during the spring months. However, in the 1974-1976 period, almost the total annual catch was made during the first four months of the year.

WEIGHT STRUCTURE OF BLUEFIN TUNA CATCHES

The analyses of landings in the 1978-1988 period showed weight of specimens to vary from 6 to 200 kg, even though smaller specimens of 3-4 kg were also recorded. It is a common practice that bigger specimens are delivered directly to fish factories where total weight of landed catches is recorded. In the case of younger fish, the number of individuals and their total weight are recorded during transportation.

The number of younger specimens caught during individual fishing trips in 1978-1988 is given in Table 3 and 4. The recorded number of bluefin tuna caught comprises specimens of 3-30 kg weight. The rest of the caught fish are specimens of 10 to 200 kg weight.

Specimens of 6-14 kg prevail in observed catches, making up 52%, while individuals of 3-5 kg make up 33.5%. This means that these catches include specimens 2-3 years old and to a lesser extent 1-year-olds. These are juveniles or fish in the pre-adult stage of development or fish just reaching first maturity (Scaccini, 1965; Morović, 1971; Farrugio, 1978).

It still seems that the specimens of 4-10 years of age make up the major part of the catches.

Morović (1971), on the basis of measurements of 426 bluefin tuna specimens caught by purse seine in 1957-1961, reported the values for fork length and weight, shown in Table 6.

This author stated that all these individuals were immature.

The length-weight relation derived from these data is:

$$W = 1.66 \times 10^{-5} FL^{2.98} \quad (r^2 = 0.97)$$

On the basis of practical experience and analysis of successive catches from the middle Adriatic over a longer time interval, Viličić (1985) concluded that young bluefin tuna grow rapidly. This author suggested that younger bluefin tuna showed a daily weight gain of 300-350 g. He also reported that young bluefin tuna weighed 2.8 - 5.8 kg during the second year of age, 10-16 kg during the third, 20-27 kg during the fourth and 30-37 kg during the fifth year of age.

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Table 1. Total catch of large pelagic fish from the eastern Adriatic in 1947-1989 (%T is percent of national catch)

Year	No. of vessels	BFT %		BON %		FRI %		LT %		TOTAL %T	
1947	-	459	46.5	295	30.5	185	19.1	22	2.3	968	5.8
1948	-	897	64.6	342	24.6	127	9.5	10	0.7	1388	5.7
1949	14	802	80.1	68	6.8	79	7.9	33	3.3	1001	4.1
1950	14	657	87.5	47	6.3	29	3.9	18	2.4	751	3.0
1951	14	531	81.2	48	7.3	52	8.0	23	3.5	654	3.9
1952	16	279	77.1	36	9.9	36	9.9	11	3.0	362	2.3
1953	21	588	92.3	21	3.3	22	3.5	6	1.7	637	3.7
1954	27	654	72.9	40	4.5	77	8.6	126	9.9	897	6.0
1955	30	346	38.4	311	34.6	195	21.7	47	5.2	898	6.6
1956	27	253	49.2	180	35.0	68	13.2	13	2.5	514	2.8
1957	29	382	84.5	27	6.0	32	7.1	22	4.9	453	2.2
1958	32	388	72.6	13	2.4	86	19.0	47	8.8	534	2.3
1959	27	224	66.4	30	8.9	72	21.4	11	3.3	337	1.8
1960	18	109	59.2	20	10.9	43	23.4	12	3.6	184	0.9
1961	15	123	46.6	82	31.1	35	13.3	24	9.1	264	1.0
1962	9	87	50.6	42	24.4	41	23.8	2	1.2	172	0.9
1963	16	277	70.3	34	8.6	75	19.0	8	2.0	394	1.8
1964	20	271	74.7	22	6.1	68	18.7	2	0.6	363	1.4
1965	14	134	61.5	30	13.8	52	23.9	2	0.9	218	0.8
1966	21	246	56.7	138	31.8	47	10.8	3	0.7	434	1.6
1967	16	331	73.2	56	12.4	58	12.8	7	1.5	452	1.5
1968	13	150	64.4	28	12.0	50	21.5	5	2.1	233	0.8
1969	17	301	78.8	17	4.5	56	14.7	8	2.9	382	1.4
1970	12	90	69.8	10	7.8	24	18.6	5	1.3	129	0.5
1971	16	326	87.6	13	3.5	29	7.8	4	1.1	372	1.2
1972	16	200	81.3	13	5.3	21	8.5	12	4.9	246	0.8
1973	14	224	90.0	4	1.6	12	4.8	9	3.6	249	0.8
1974	16	317	90.3	10	2.8	22	6.3	4	1.1	351	1.2
1975	13	155	77.5	9	4.5	16	8.0	20	9.9	200	0.6
1976	16	562	92.9	23	3.8	18	3.0	2	0.3	605	1.7
1977	14	932	94.5	26	2.7	24	2.6	4	0.4	986	2.8
1978	15	1049	94.2	39	3.5	23	2.1	0	-	1111	3.0
1979	16	756	94.1	29	3.6	17	2.2	0	-	802	2.4
1980	13	573	86.5	72	10.8	19	2.9	0	-	664	1.9
1981	12	376	87.6	39	9.1	14	3.3	0	-	429	1.0
1982	14	486	86.6	61	10.8	14	2.6	0	-	561	1.4
1983	13	1222	96.1	31	2.4	18	1.4	1	0.1	1272	2.4
1984	14	755	92.9	37	4.5	16	1.9	6	0.7	814	1.7
1985	14	1084	95.6	34	3.0	14	1.3	1	0.1	1133	2.3
1986	13	796	91.8	38	4.3	32	3.7	1	0.1	867	1.7
1987	14	648	89.3	62	8.5	14	1.9	2	0.3	726	1.4
1988	15	1523	94.8	36	2.2	41	2.6	5	0.4	1605	3.5
1989	14	560	79.5	98	13.9	42	7.0	4	0.6	704	1.5

Table 2. Monthly bluefin tuna catch frequency distribution for the eastern Adriatic, 1963-1989

Year	Months											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1963	-	-	17.8	3.5	1.1	58.8	163.7	24.0	5.4	2.6	0.1	-
1964	-	0.1	0.1	5.5	74.1	21.5	34.3	48.8	59.7	10.2	13.3	1.0
1965	-	1.2	4.1	4.6	0.9	18.3	3.2	36.4	41.5	17.5	3.8	0.8
1966	0.1	-	-	0.4	0.9	0.7	55.7	60.2	67.4	30.3	11.9	16.7
1967	0.5	0.3	0.3	5.0	11.1	0.2	0.1	157.9	86.4	46.7	22.2	0.3
1968	0.2	0.3	3.3	1.1	1.8	11.9	9.4	15.3	61.1	27.2	15.8	0.9
1969	0.5	0.6	0.4	0.5	44.1	2.4	10.7	94.1	134.2	10.2	1.9	1.0
1970	0.8	0.6	0.3	4.3	49.6	9.4	3.4	0.4	14.9	5.7	0.6	0.4
1971	0.6	0.3	0.7	36.8	14.9	14.2	134.5	55.2	40.2	8.6	1.0	18.6
1972	0.7	0.5	39.0	32.2	18.1	0.7	13.4	5.7	27.4	54.4	1.2	6.1
1973	0.6	0.4	0.1	10.5	40.1	5.6	0.3	47.9	57.3	4.5	55.9	0.6
1974	105.6	29.2	47.4	19.2	4.8	7.8	34.7	19.4	23.5	0.3	17.4	7.4
1975	0.8	0.2	30.8	61.0	20.5	5.4	0.2	5.4	14.4	14.6	0.3	1.0
1976	0.6	23.6	134.6	60.7	48.6	103.3	79.2	57.8	50.5	1.2	1.8	0.5
1977	3.6	0.1	129.7	19.9	76.1	142.4	259.9	124.8	61.9	89.6	20.6	3.1
1978	0.5	0.2	23.4	13.6	240.4	136.3	26.1	188.4	391.2	20.5	1.7	6.7
1979	0.6	0.2	0.3	24.8	158.9	182.8	297.4	199.1	37.8	2.6	1.1	21.4
1980	1.0	39.0	21.0	78.0	98.0	95.0	21.0	163.0	32.0	1.0	1.0	11.0
1981	2.0	1.0	16.0	6.0	18.0	6.0	150.0	13.0	99.0	64.0	2.0	1.0
1982	16.0	85.0	48.0	103.0	13.0	46.0	23.0	142.0	7.0	1.0	1.0	-
1983	0.3	4.0	148.0	106.8	61.2	156.0	237.0	252.0	223.0	1.9	28.0	0.2
1984	-	-	2.0	4.0	2.0	127.0	50.1	255.5	176.1	126.4	10.1	0.3
1985	0.4	0.2	1.8	15.8	406.8	188.0	121.0	188.2	73.0	55.0	1.0	0.2
1986	-	0.3	10.0	20.0	11.0	72.0	244.0	302.0	115.0	2.0	1.0	-
1987	1.0	0.2	1.0	176.0	6.0	2.0	-	2.0	216.0	236.0	0.5	-
1988	1.0	92.0	51.0	59.0	255.0	149.0	65.0	404.0	239.0	197.0	7.0	4.0
1989	4.0	12.0	7.0	2.0	20.0	0.5	4.0	240.0	238.0	239.2	2.2	1.3
%	1.0	2.0	5.3	5.3	12.2	10.7	13.8	21.2	17.7	8.7	1.5	0.7

Table 3. Structure of the catches of younger bluefin tuna as percentages of the total number of individuals (A) and their total weight (B) 1978-1988.

Individual weight range (kg)	A	B	Individual mean weight (kg)
3 - 5	33.5	11.8	3.98
6 - 8	18.4	14.5	6.93
9 - 11	15.5	16.5	10.08
12 - 14	18.0	24.4	12.94
15 - 17	3.8	6.4	16.00
18 - 20	4.1	8.4	19.04
21 - 23	1.0	2.4	21.73
24 - 26	4.0	10.7	25.11
27 - 29	1.4	4.1	28.07
30 - 32	0.1	0.3	31.11
33 - 35	0.1	0.2	34.18

Table 4. Annual weight distribution frequency of catches of younger bluefin tuna for the eastern Adriatic in 1978-1988.

W(kg)	Y e a r s									
	1978	1979	1981	1982	1983	1984	1985	1986	1987	1988
3	897	1358	244	2944	1531	182	800	9044	-	19326
6	-	36	1399	-	5377	479	472	1907	-	6995
9	6166	1391	230	3208	455	197	845	3848	2593	6719
12	1361	1556	743	117	3703	4688	859	4177	-	4728
15	802	-	123	-	210	-	408	243	1361	1040
18	681	-	-	-	-	-	384	192	100	2516
21	-	-	-	-	-	-	429	-	-	1795
24	-	-	-	-	80	-	-	634	-	3447
27	-	-	-	-	-	-	-	-	-	1148
30	-	-	-	-	-	-	-	81	-	-

Table 5. Length-weight data for bluefin tuna. (Morović, 1971)

FL (cm)	W (kg)	FL (cm)	W (kg)	FL (cm)	W (kg)
50	2.5	90	10.0	120	25.5
60	3.0	100	13.0	128	30.0
70	4.5	102	14.0	129	35.0 - 40.0
80	8.5	108	17.0	130	40.0 - 50.0

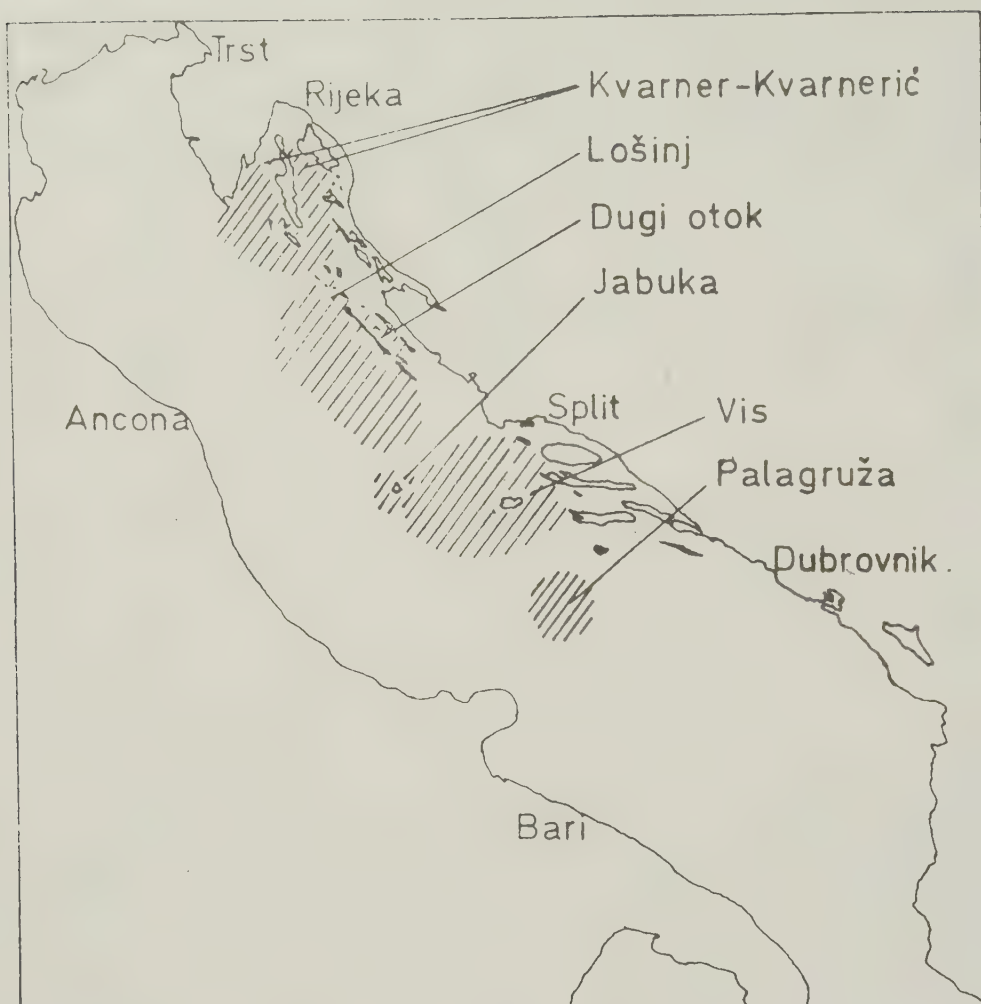


Fig. 1. Bluefin tuna fishing areas in the eastern Adriatic

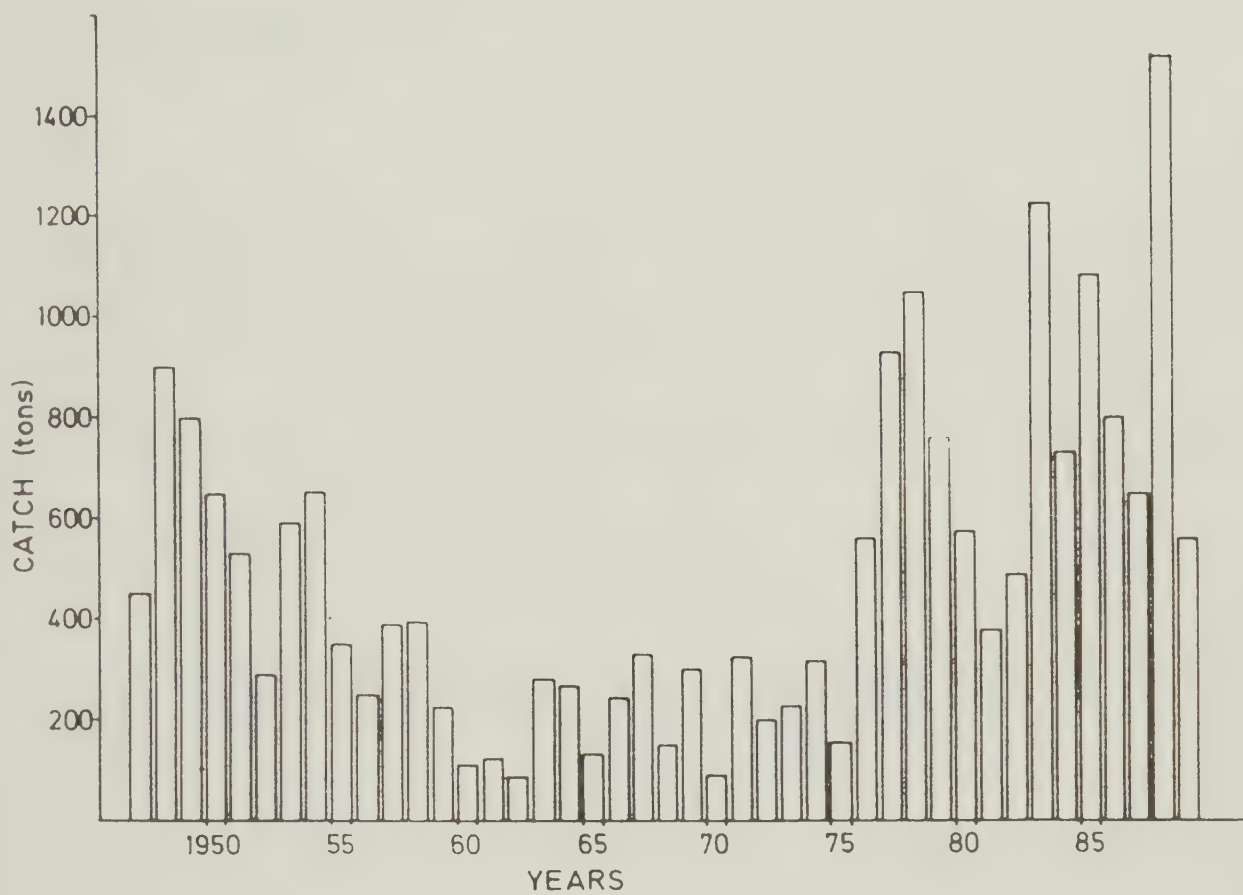


Fig. 2. Annual catch of bluefin tuna in the eastern Adriatic, 1947-1989

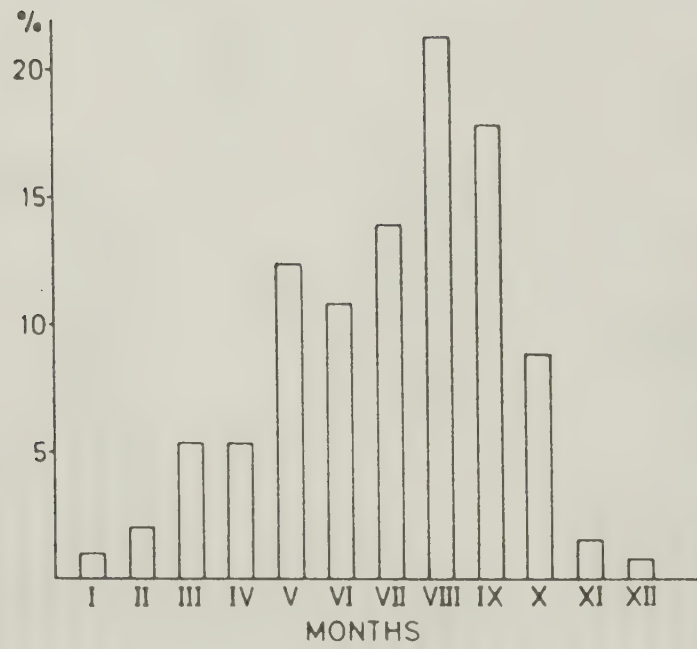


Fig. 3. Seasonal variations of bluefin tuna catch in the eastern Adriatic

FORK-LENGTH AND MEAN AGE STRUCTURE OF SOUTH TYRRHENIAN PURSE SEINE
BLUEFIN TUNA CATCH FOR THE YEARS 1982 AND 1984 TO 1988.

by Pasquale ARENA
ESPI - Palermo (Italy)

With the aim to contribute for more extensive studies on Bluefin tuna (Thunnus thynnus (L.)) stocks of the Atlantic and Mediterranean, in the past years we made available to ICCAT Data Bank a number of sets of fork-length data, mostly collected in the south tyrrhenian spring-summer fishery and pertaining to the following ensembles of fish:

- a) tuna caught by coastal tuna traps during the years 1959-1961-1963-1965-1966-1967-1968, also including weight values in the latter year (ICCAT Data Record, no. 8);
- b) tuna caught by the tyrrhenian purse seiners fleet during years 1975-1977-1978-1979-1980-1981 (ICCAT SCRS 81/51).

Furthermore, we can give new sets of fork-length data collected during years 1982-1984-1985-1986-1987-1988 from samples of bluefin tuna catches achieved by purse seiners, still in the south tyrrhenian area (Tab. I).

It necessary to point out here that the first set of data (1982) was collected in the course of a research on tuna and tuna-like fishes supported by the italian National Research Council, while the others (1984 to 1988) have arisen from surveys being part of a plan on pelagic fish resources investigations granted by the italian Ministry of Merchant Marine.

The fork-length values are presented here by class intervals of 5 cm., while the frequency values are drawn up on histograms of Fig. 1 to 6. Besides, the frequency values of the corresponding mean ages are shown into Fig. 7 to 12.

A rough age structure of the catch is reported for each year into Tab. II.

From the ensemble of data and values presented here, it can be seen that many bluefin tuna enter in the tyrrhenian spring-summer fishery at the age of 3 years. Sometimes they form at sea homogenous separate schools; but often they enter also in the breeding schools of older fishes, where usually they keep some distinct emplacements and behavioural features, together with tunas of 4 years old.

Gonads development and maturative stages of the above mentioned age groups of tuna resulted to our observations well advanced in many cases; but it seemed that eggs dont reach full maturity (the translucent and floating ones were lacking) and that only in a few instances initial spawning apparently took place, with a very partial depletion of the ovaries.

Tentative estimates of Z.

On the base of the above reported fork-length data series we are making here an attempt to estimate the hypothetical values of total mortality (Z) by utilizing the descendent parts of the catch curves and plotting values against age (t) in the form of the following linear regression (PAULY, 1983):

$$\log_e (N/\Delta t) = a + bt \quad (\text{where } \underline{b} \text{ is estimator of } Z)$$

For such an aim, we consider comparatively the parameters values (VB growth curve) estimated by ARENA, CEFALI & MUNAO' (1980):

$$L_{\infty} = 455,89; \quad K = 0,00507; \quad t_0 = -1,6128$$

and those estimated by FARRUGIO (1980):

$$L_{\infty} = 351,13; \quad K = 0,080 \quad ; \quad t_0 = -1,087.$$

Owing to the bimodal shape of the catch curve, as can be seen from the fork-length and age frequency figures, we consider also two portions of the whole diagram: the one pertaining to small and medium sized tuna and the other pertaining to giant tuna.

The resulting values are the following:

Year	Small & medium tuna		Giant tuna	
	(A)	(F)	(A)	(F)
1982	0,69	0,77	0,66	0,41
1984	0,61	0,62	0,82	0,50
1985	0,86	0,97	0,92	0,80
1986	0,41	0,31	0,89	0,70
1987	0,65	0,74	0,37	0,37
1988	1,03	1,03	0,82	0,67

(A) and (F) respectively indicate series of Z obtained by utilizing growth parameters values of ARENA & Oth. and those of FARRUGIO.

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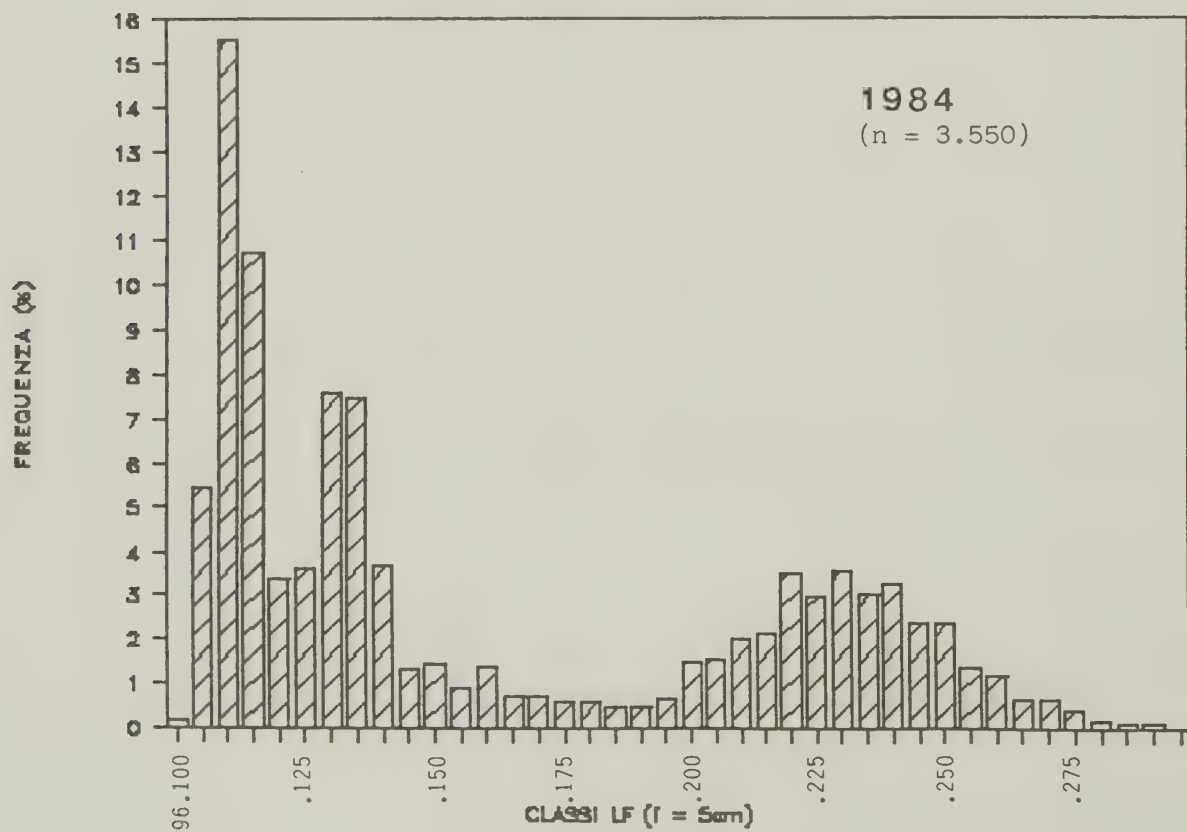
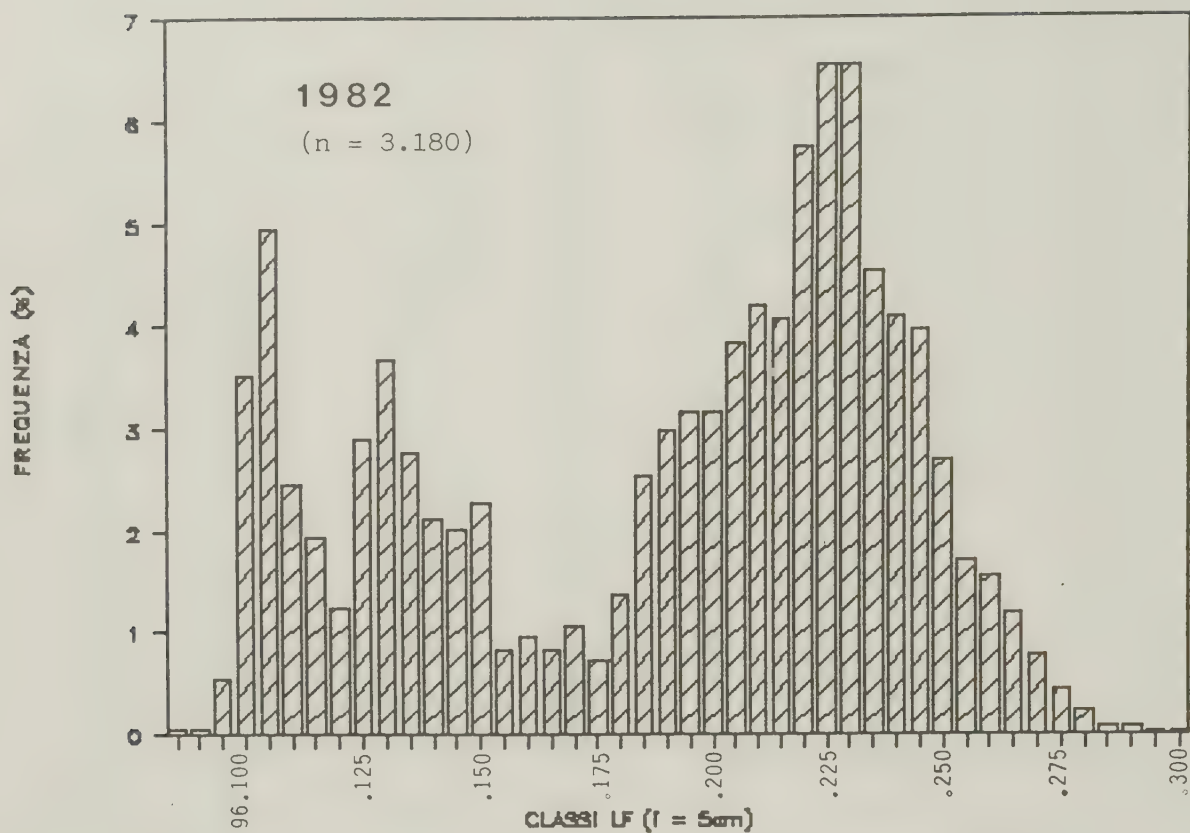
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FORK-LENGTH (i = 5 cm)	1982 (n.)	1984 (n.)	1985 (n.)	1986 (n.)	1987 (n.)	1988 (n.)
80 - 84.9	2	-	-	-	-	-
85 - 89.9	2	-	4	-	-	-
90 - 94.9	18	-	12	-	-	-
95 - 99.9	112	7	22	-	2	7
100 - 104.9	157	194	37	-	6	10
105 - 109.9	78	551	32	2	8	8
110 - 114.9	38	380	44	5	20	2
115 - 119.9	40	120	131	41	53	11
120 - 124.9	92	129	176	32	67	18
125 - 129.9	117	269	192	21	64	25
130 - 134.9	88	264	196	33	69	12
135 - 139.9	68	130	98	64	46	11
140 - 144.9	64	47	80	47	38	4
145 - 149.9	73	51	74	64	39	6
150 - 154.9	27	33	46	39	22	4
155 - 159.9	31	50	35	34	23	4
160 - 164.9	27	26	37	42	19	3
165 - 169.9	34	26	23	35	9	6
170 - 174.9	23	21	10	34	18	4
175 - 179.9	44	21	18	22	13	8
180 - 184.9	81	17	29	17	17	7
185 - 189.9	95	18	22	21	11	7
190 - 194.9	101	23	21	17	16	8
195 - 199.9	101	53	30	45	23	15
200 - 204.9	122	55	60	23	22	19
205 - 209.9	133	71	71	41	21	20
210 - 214.9	129	77	109	40	19	22
215 - 219.9	183	124	120	75	32	35
220 - 224.9	208	106	160	106	28	30
225 - 229.9	208	126	141	144	30	45
230 - 234.9	144	107	131	100	30	41
235 - 239.9	140	116	97	117	27	42
240 - 244.9	126	85	78	85	16	29
245 - 249.9	80	84	41	70	17	18
250 - 254.9	55	48	34	46	13	14
255 - 259.9	50	42	20	22	10	17
260 - 264.9	38	23	14	11	-	4
265 - 269.9	25	23	8	11	1	5
270 - 274.9	14	15	2	-	-	2
275 - 279.9	8	8	1	4	-	-
280 - 284.9	3	5	1	2	-	-
285 - 289.9	3	4	-	1	-	1
290 - 294.9	1	1	-	-	-	-
295 - 299.9	1	-	-	-	-	-
Total Samples	3.180	3.550	2.458	1.513	851	524

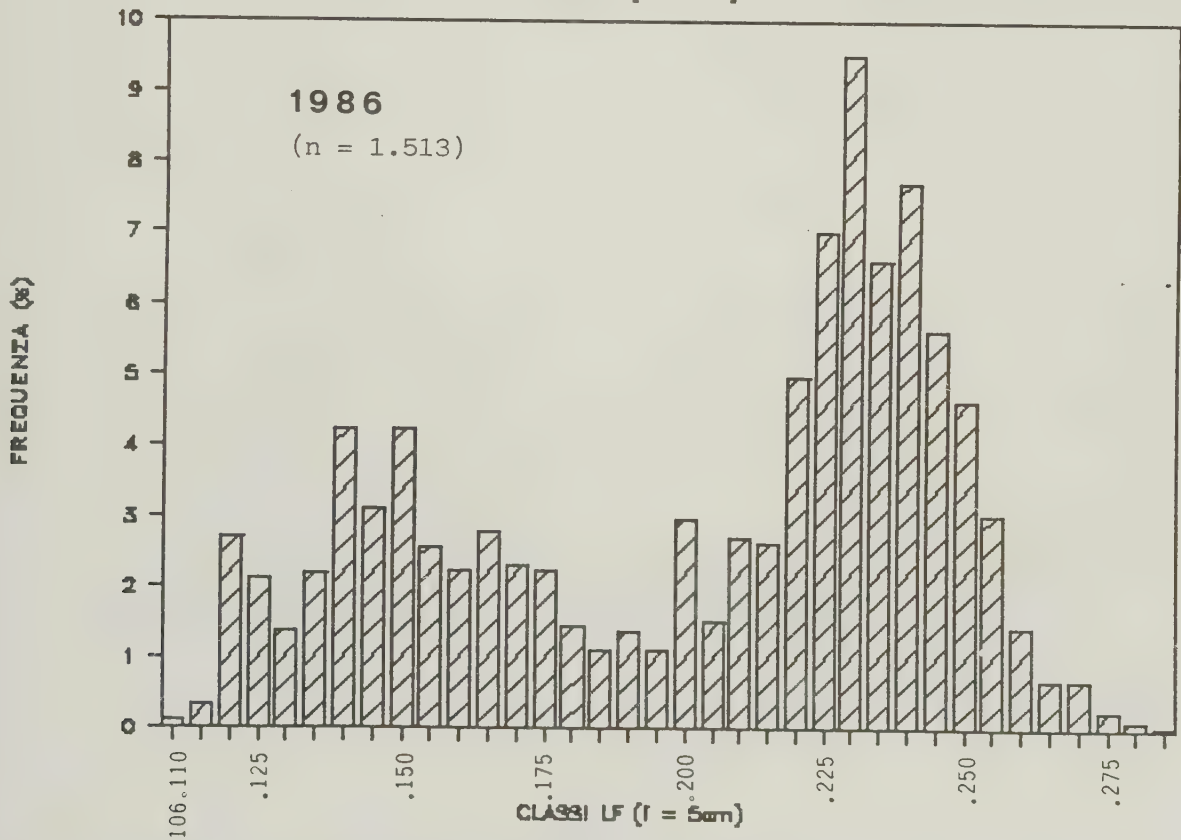
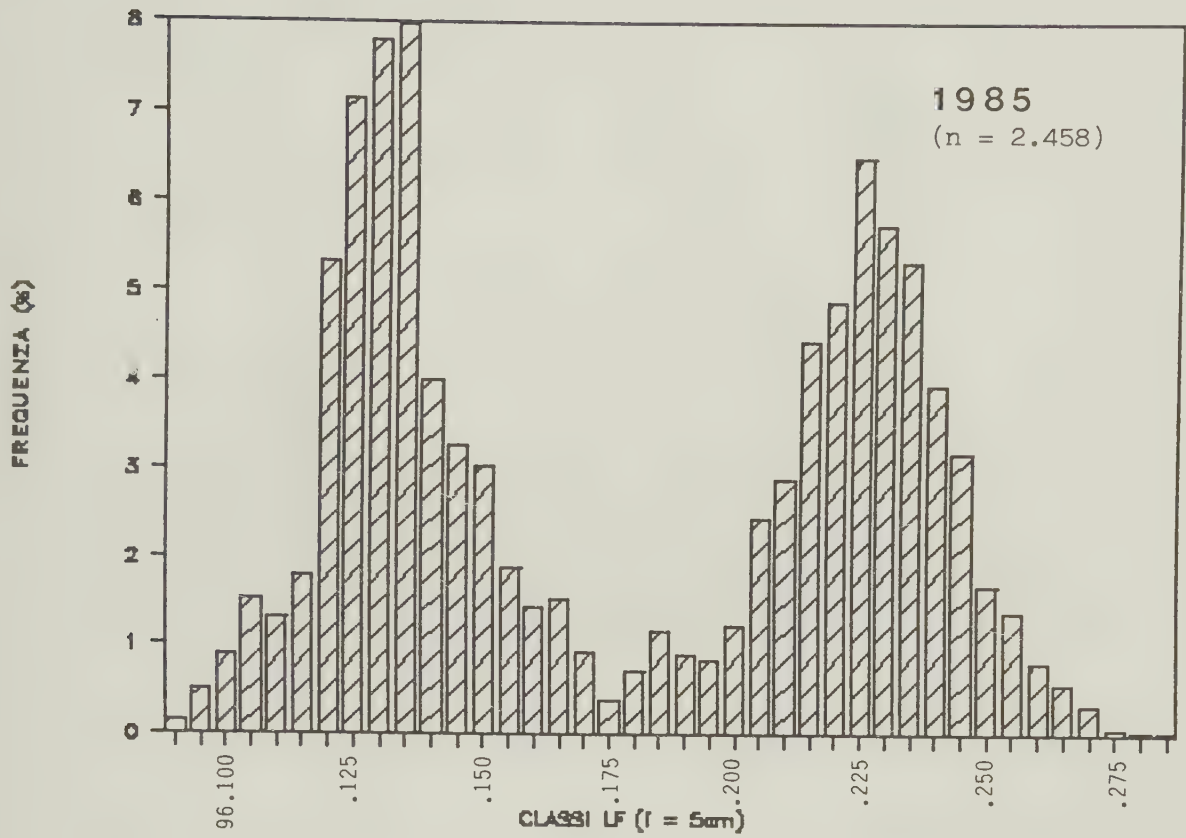
TAB. I - Fork-length distribution of sampled Bluefin tuna.

AGE (years)	1982 (n.)	1984 (n.)	1985 (n.)	1986 (n.)	1987 (n.)	1988 (n.)
2	146	-	92	-	-	-
3	2.556	9.968	778	43	208	101
4	2.237	6.886	4.008	771	1.460	246
5	1.361	2.008	1.453	1.063	710	78
6	564	960	680	698	369	41
7	670	599	294	553	231	67
8	1.839	511	415	334	254	82
9	1.480	951	519	413	260	127
10	1.739	1.302	1.038	492	231	156
11	2.596	2.025	1.615	1.099	346	242
12	2.337	2.052	1.568	1.481	346	321
13	1.699	1.770	1.009	1.226	248	265
14	936	1.162	433	704	173	119
15	584	572	196	200	68	78
16	259	335	57	67	6	26
17	73	114	11	37	-	-
18	20	35	-	6	-	4
19	7	9	-	-	-	-
20	6	-	-	-	-	-
Total catch	21.109	31.260	14.174	9.187	4.910	1.953

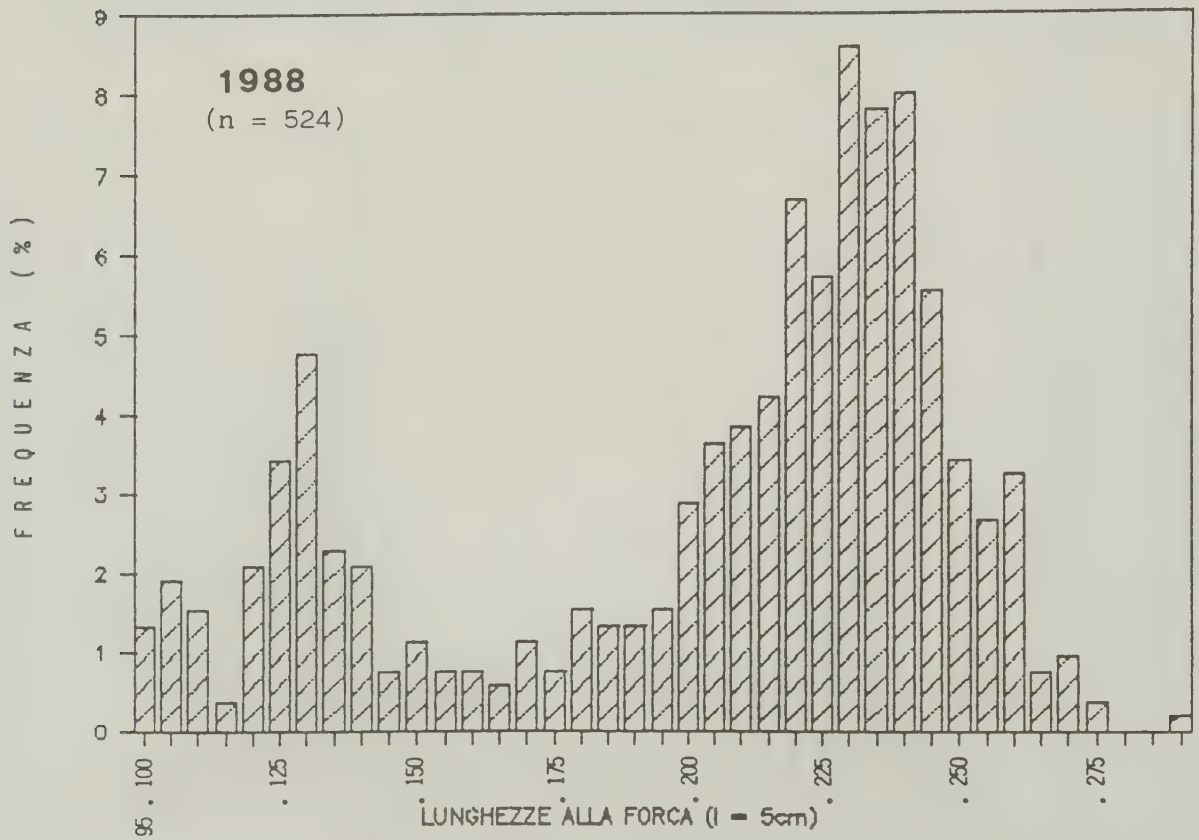
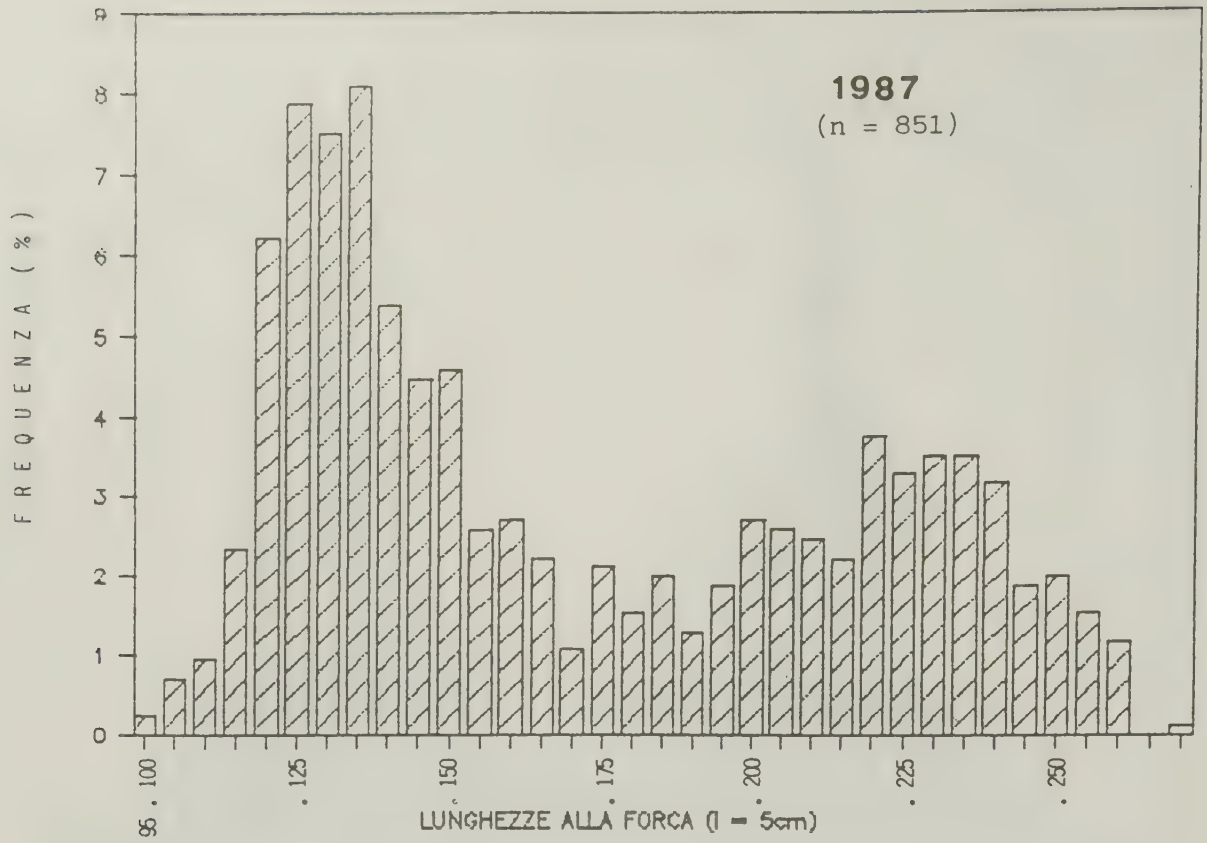
TAB. II - Distributive figures by approximate ages of Bluefin tuna caught in South Tyrrhenian by italian purse-seiners.



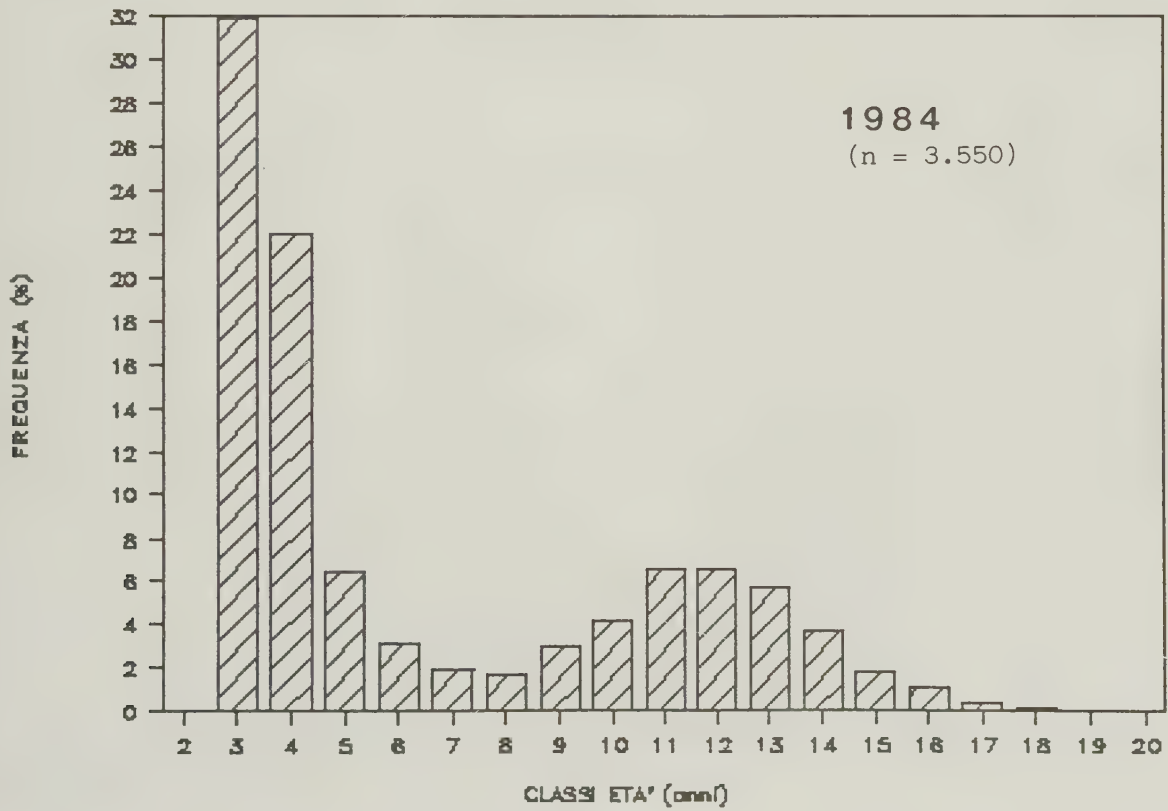
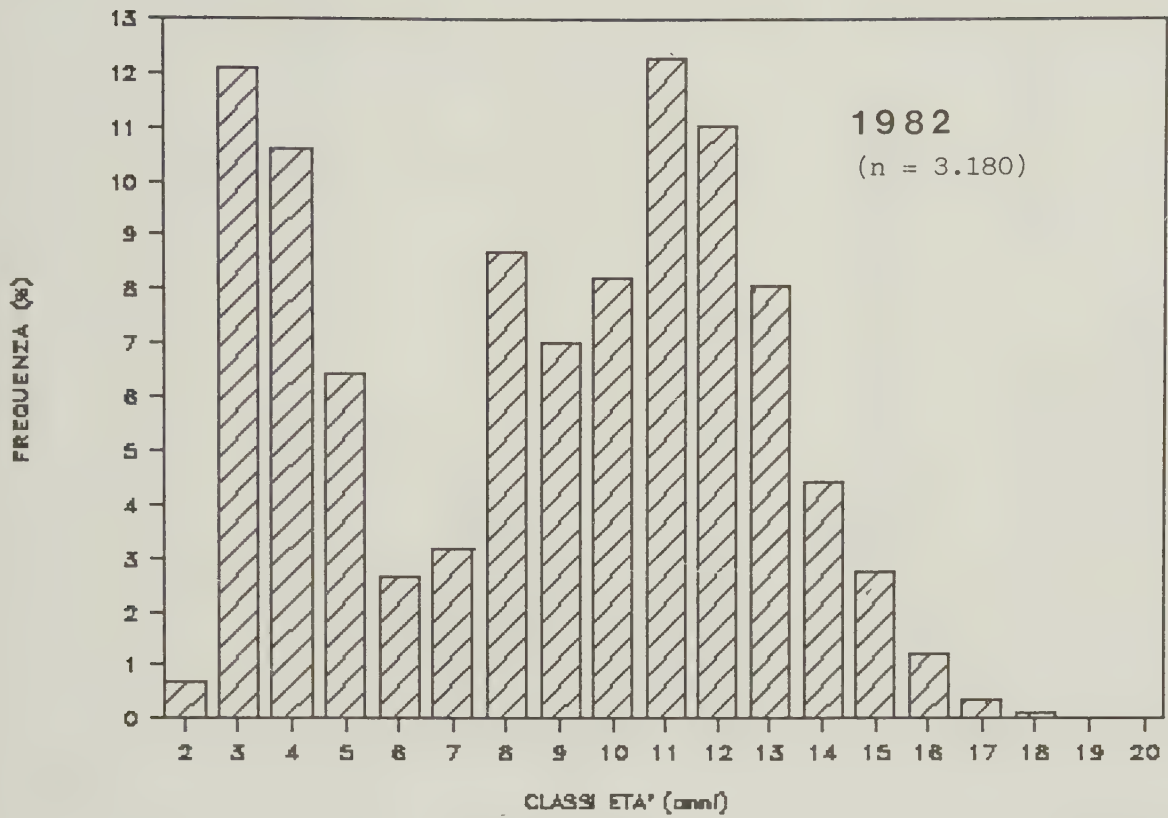
FIGG. 1 - 2 : BFT fork-length frequencies (5 cm. class in %)



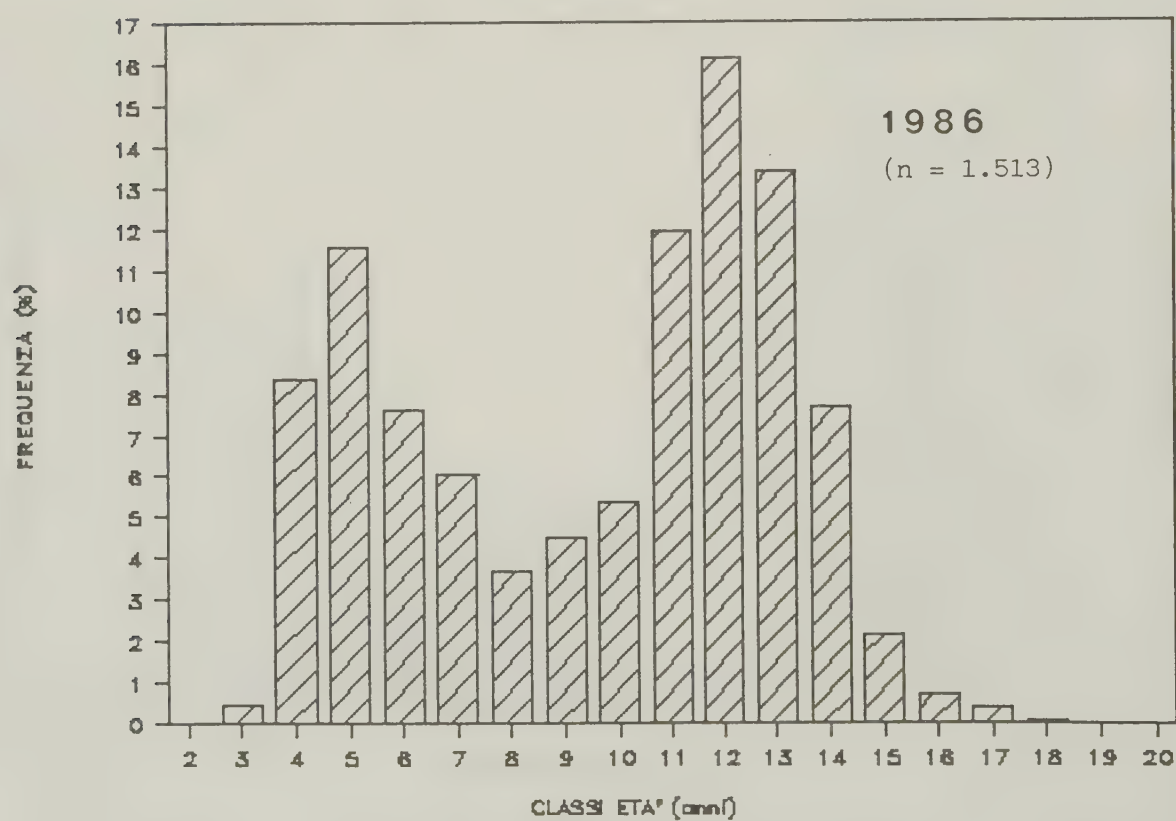
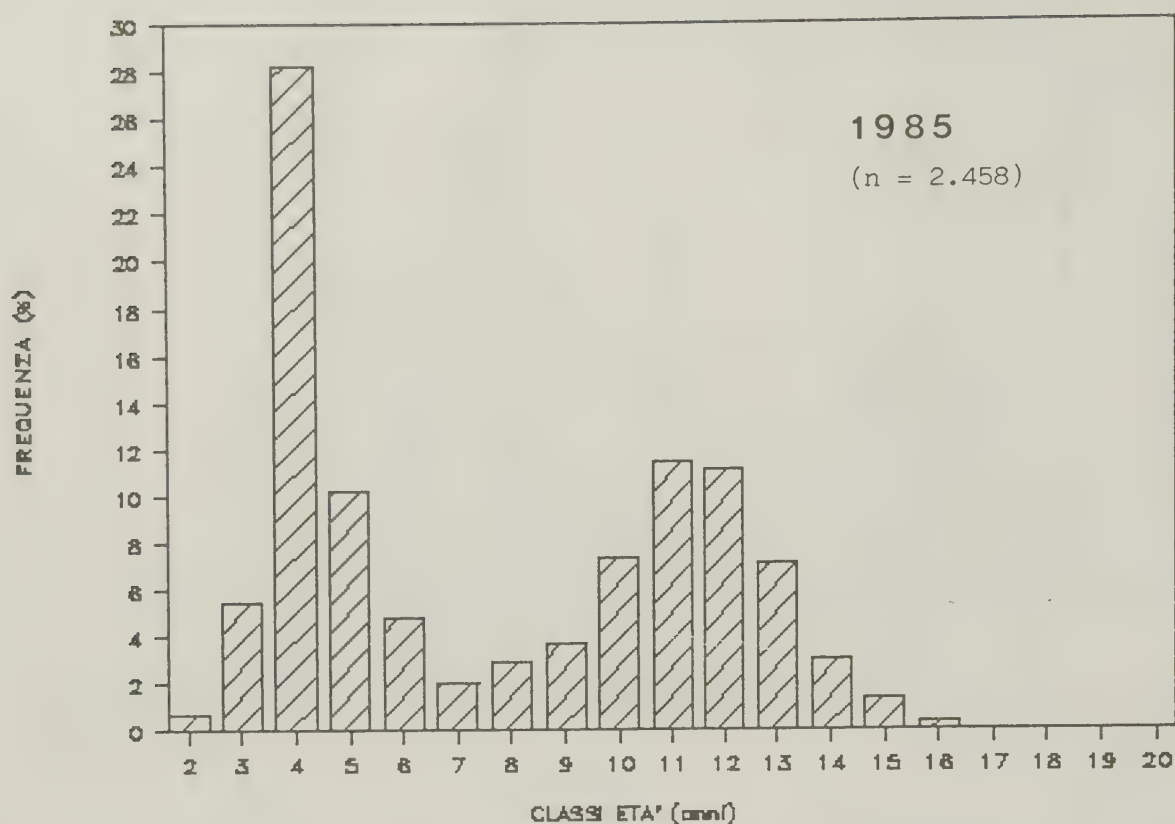
FIGG. 3 - 4 : BFT fork-length frequencies (5 cm. class in %)



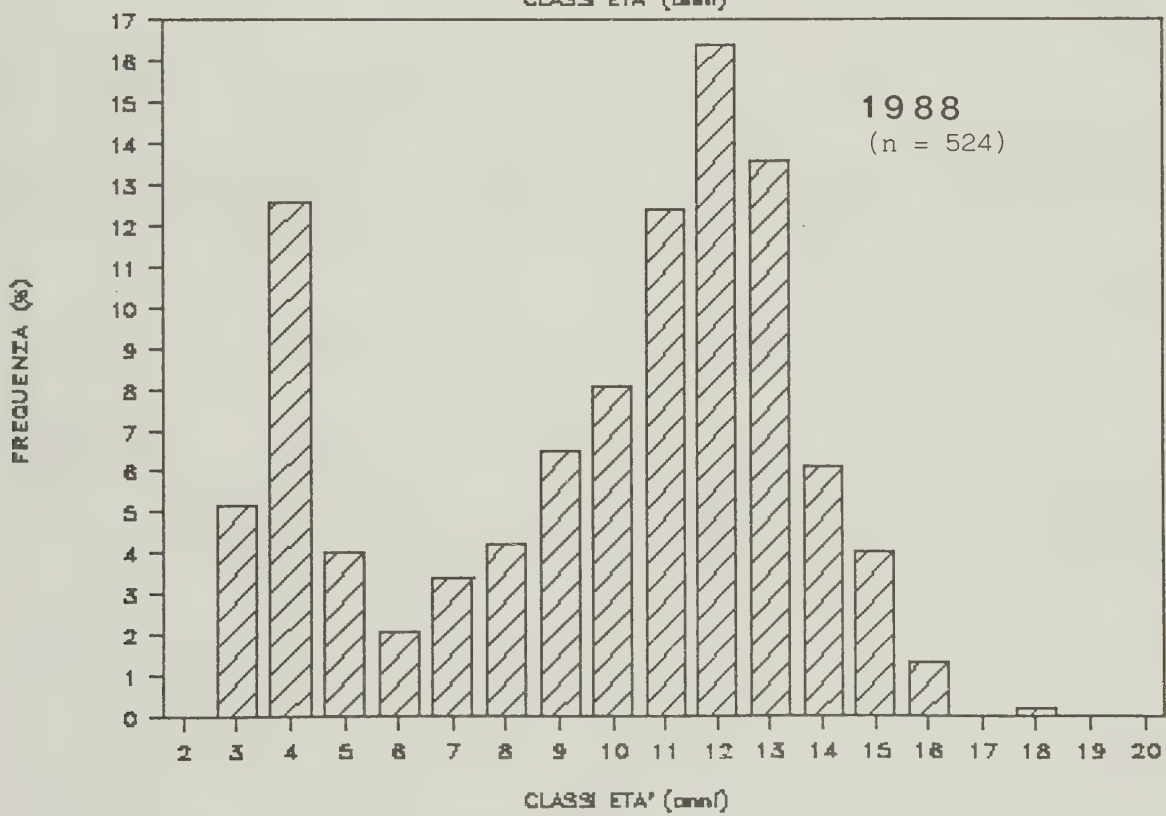
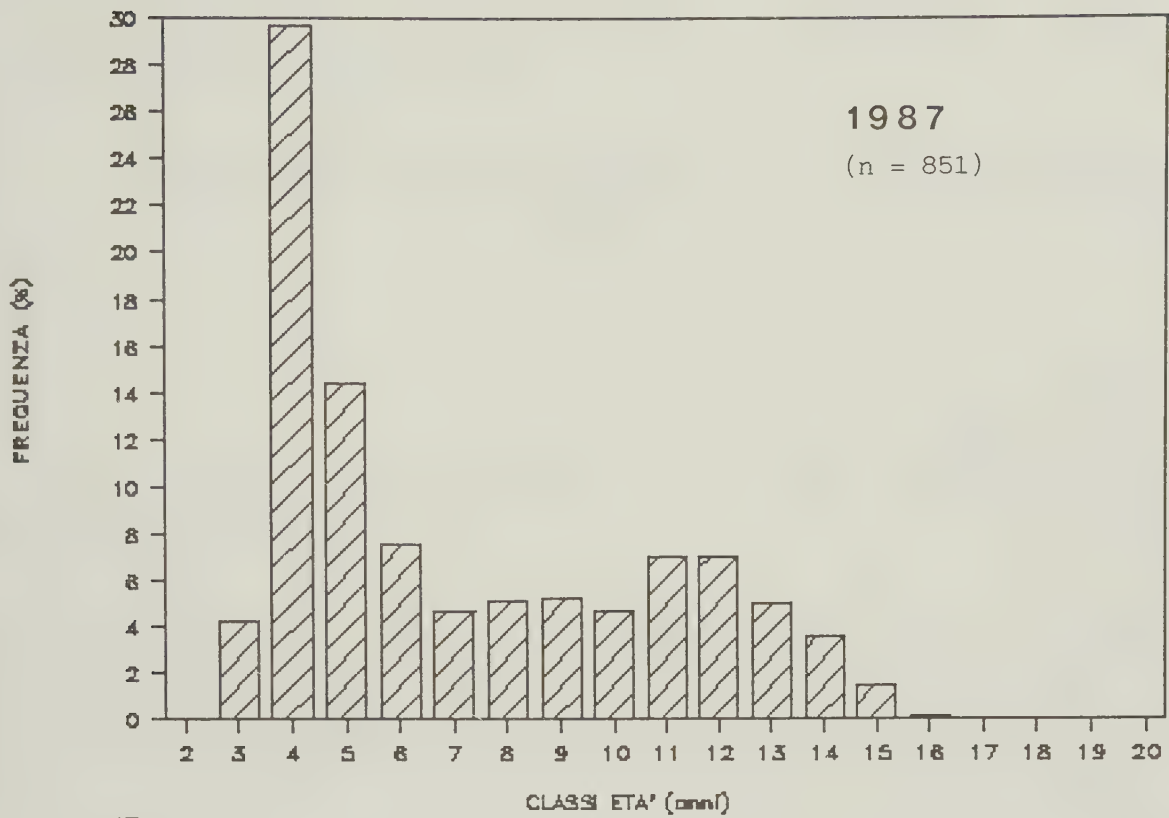
FIGG. 5 - 6 : BFT fork-length frequencies (5 cm. class in %)



FIGG. 7 - 8 : BFT mean ages frequencies (5 cm. class in %)



FIGG. 9 - 10 : BFT mean age frequencies (5 cm. class in %)



FIGG. 11 - 12 : BFT mean ages frequencies (5 cm. class in %)

ALCUNE CARATTERISTICHE BIOLOGICHE DELL'ALALUNGA, *Thunnus alalunga*

(Bonn.), DEL TIRRENO.

(SOME BIOLOGICAL FEATURES OF ALBACORE, *Thunnus alalunga* (Bonn.),
IN THE TYRRHENIAN SEA)

Pasquale ARENA
ESPI - Palermo

RIASSUNTO

L'Alalunga del Tirreno differisce morfologicamente da quella dell'Atlantico per avere la testa leggermente più sviluppata, in rapporto alla lunghezza del corpo, e le pinne pettorali relativamente più corte.

L'accrescimento con l'età, tranne che nel primo anno, presenta valori pressoché analoghi a quelli delle alalunghe dell'Atlantico e del Pacifico. I valori rilevati nei parametri di accrescimento sono i seguenti: $L_{inf} = 98,55$; $K = 0,4063$; $t_0 = -0,6259$. E' stato rilevato altresì il seguente rapporto della relazione taglia/peso:

$$W_t = 147 \cdot 10^{-7} \cdot L_t^{3009}$$

La prima maturità sessuale risulta essere raggiunta all'inizio del secondo anno di età ed a 62 cm. di lunghezza alla forca caudale.

Il Tirreno meridionale é un'area di riproduzione molto importante per l'Alalunga, che qui tende a formare dei popolamenti stabilmente localizzati per lungo periodo. Da parte di un Autore francese è stato peraltro segnalato nel Tirreno il recupero di un esemplare che era stato marcato nell'Atlantico.

SUMMARY

The Tyrrhenian Albacore differs from that of the Atlantic for some morphometrical features, such as a slight longer head and a shorter pectoral fin.

Its growth related to age shows fork-length values, with exceptions for the first year, almost equivalent to those of Atlantic and Pacific Albacores. The established growth parameters are the following: $L = 98,55$; $K = 0,4063$; $t_0 = -0,6258$. The following length/weight relationship was established also:

$$W_t = 147 \cdot 10^{-7} \cdot L_t^{3009}$$

The first sexual maturity resulted to be reached at the age of 2 years and at a size of 62 cm. in fork-length.

Some marking results showed some tendencies to stability of the peoplements that breed in Tyrrhenian areas. The recovery in this area of a specimen marked in Atlantic and reported many years ago by a French author seems exceptional.

AGE	no.	Fork-length			Weight		
		min. (cm)	max. (cm)	mean (cm)	min. (kg)	max. (kg)	mean (kg)
0,5	19	32,0	41,0	38,3	0,55	1,25	1,01
1	1	45,0	45,0	45,0	1,60	1,60	1,60
2	7	62,0	70,5	66,3	4,70	6,70	5,48
3	75	61,5	85,0	75,4	4,60	12,00	8,78
4	20	72,0	88,0	78,1	8,00	11,40	9,06

TAB. I - Valori di crescita in lunghezza ed in peso in relazione all'età dell'Alalunga del Tirreno (ARENA, POTOSCHI e CEFALI, 1980).

TAB. I - Length and weight values related to age observed on tyrrhenian Albacore (ARENA, POTOSCHI & CEFALI, 1980).

AREA	AGE (years)				Growth parametres		
	1	2	3	4	K	L	t ₀
	(cm)	(cm)	(cm)	(cm)			
Pacific BELL, 1962	56,4	67,0	75,4	82,1	0,225	109	-2,27
Atlantic BARD & Oth. 1979	50,0	63,0	74,0	84,0	0,228	125	-0,99
Tyrrhenian ARENA & Oth. 1980	47,6	64,6	75,6	83,5	0,406	98,5	-0,62

TAB. II - Comparazione di valori di lunghezza in rapporto all'età e dei parametri di accrescimento in alalunghe del Pacifica, dell'Atlantico e del Tirreno.

TAB. II - Comparative values of body length related to age and growth parameters of pacific, atlantic and tyrrhenian albacore.

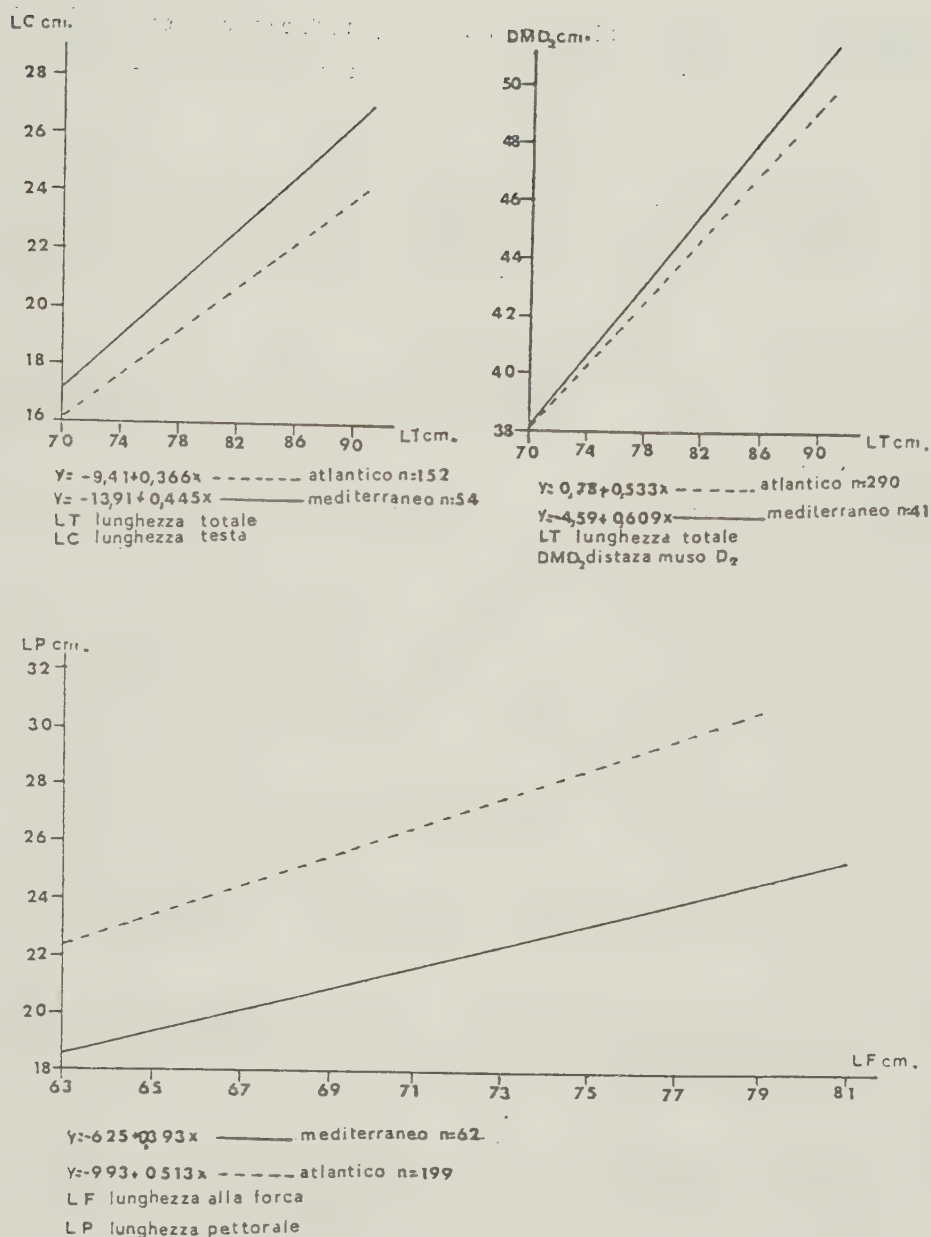


FIG. 1 - Comparazione delle regressioni lineari su alcuni parametri morfometrici dell'Alalunga del Tirreno e dell'Atlantico.

LC = lunghezza del capo; LP = lunghezza della pinna pettorale;
 DMD₂ = distanza muso - 2a pinna dorsale.

FIG. 1 - Comparison of linear regressions of some morphometric parameters on tyrrhenian and atlantic Albacore.

LC = head length; LP = pectoral fin length; DMD₂ = snouth - 2nd dorsal fin space.

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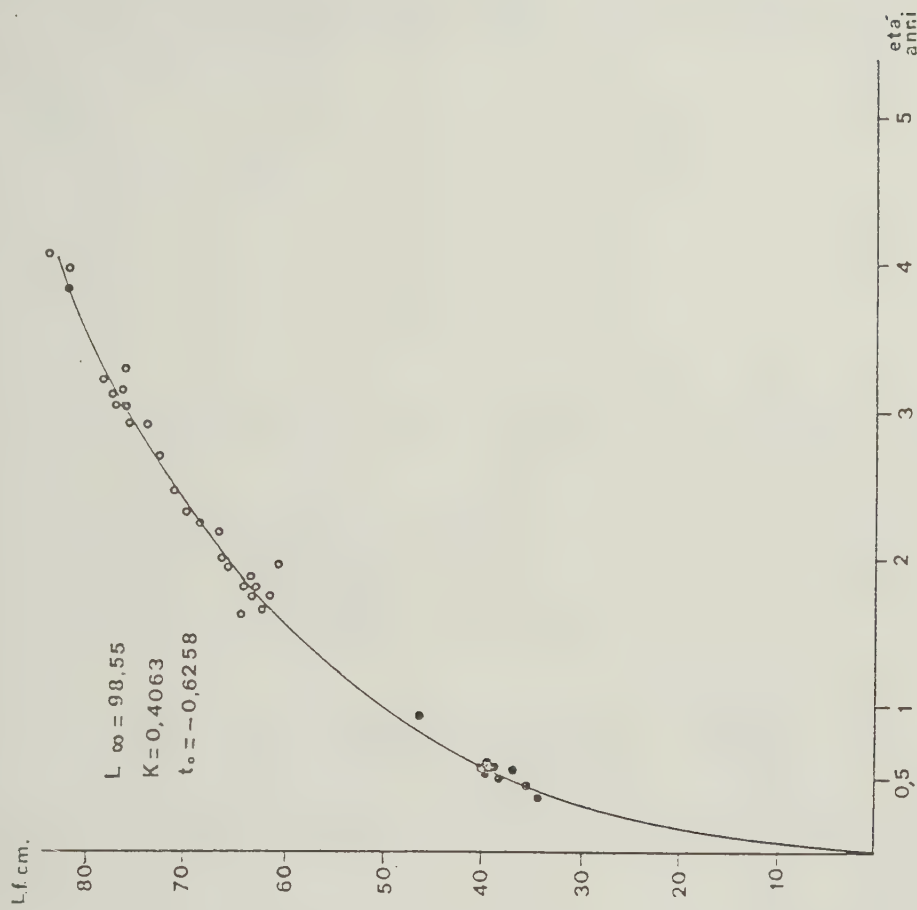


Fig. - Grafico di accrescimento secondo l'equazione di Von Bertalanffy e di dispersione dei valori di LF osservati.
 ● = individui immaturi ○ = individui sessualmente maturi.

Growth curve of Mediterranean Albacore (Von Bertalanffy equation) and dispersion figure of the observed fork-length values.
 ● = immature specimens; ○ = mature specimens.

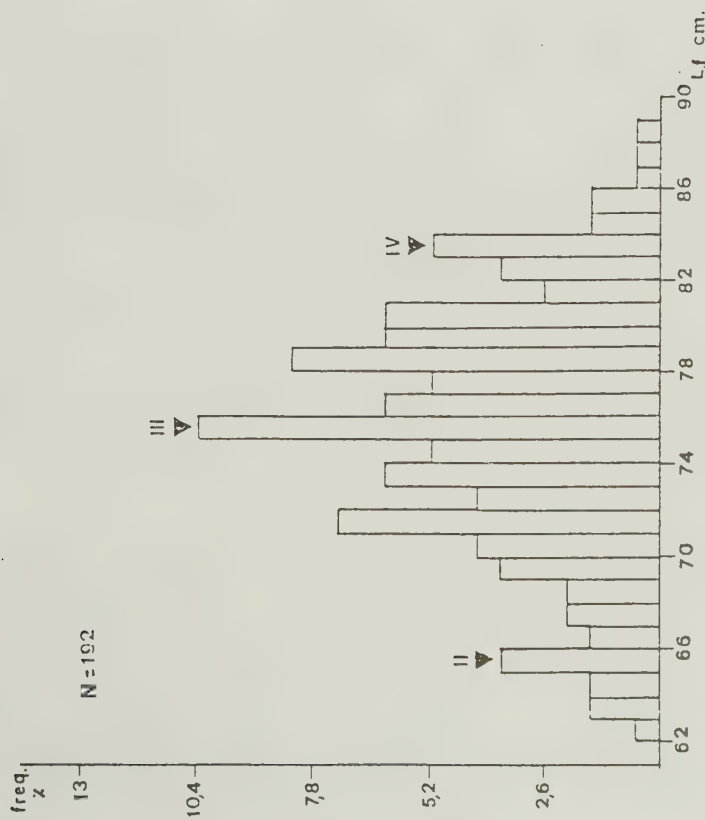


Fig. - Istogramma di frequenza delle lunghezze alla forca (LF) misurate su alalunghe pescate nel periodo Maggio-Luglio 1979. Sono indicate le classi modali che individuano le corrispondenti classi di età.

Fork-length frequency histogram of Albacores caught in May-July 1979. The modal length classes that indicate the corresponding age-classes are marked with roman numbers.

CATCH AND EFFORT OF THE BLUEFIN TUNA PURSE SEINE FISHING IN SOUTH TYRRHENIAN AREA.

by Pasquale ARENA
ESPI - Palermo (Italy)

The bluefin tuna fishing by purse seiners, in South Tyrrhenian, almost began during the years 1970-1971.

In the Tab. I are reported the annual size and tonnage class composition of the fleet engaged in this fishery while, in the successive Tab. II, are shown historical series of catch, effort and CPUE.

The effort (f) here considered is expressed as days at sea for each vessel engaged in fishing activities.

Catch and CPUE values show an increasing trend up to 1975. After this year a descending tendency in CPUE takes place, with the exception of some moderate recoveries during 1980 and 1983. At last this trend involved a strong decrease on fleet size, together with a sharp fall of catch and fishing effort.

These events seem not quite the exclusive effect of a comparable depauperation of tuna stocks or populations sustaining the seasonal migration in the south tyrrhenian breeding area.

By another part, observations performed during aerial surveys contributed to indicate a lower accessibility and catchability of tuna groups. In this respect, it is to be pointed out that a fast increase of pelagic gill-nets for swordfish fishing took place in the above considered area after 1975. It seems that the frequent impact of tuna tracks against these barriers involves at last marked troubles and changements on behaviour, shoaling and environmental allocations of fishes.

Setting an equilibrium curve

By utilizing the historical series of catch and effort data, we have made a first attempt to draw out a curve of equilibrium yield using the SCHAEFER (1954) model.

The linear regression of CPUE values plotted against effort (f) gave the parameters of the curve, traced out in Fig. 1. The maximum sustainable yield (MSY) resulted in 4.167 metric tons; that equals almost the yield values of purse seine tuna fishing during years 1975-1976-1977.

The optimal effort (opt.f) resulted in 1.667 days of fishing. This almost represents the double of the maximum effort practised by the italian tuna purse seiners fleet operating in the south tyrrhenian area.

YEAR	T O N N A G E C L A S S				Total (no.)
	100-200 GRT	201-300 GRT	301-400 GRT	400 ⁺ GRT	
1971	6	-	-	-	6
1972	8	-	-	-	8
1973	12	-	-	-	12
1974	14	-	-	-	14
1975	14	-	-	-	14
1976	15	2	-	-	17
1977	15	6	-	1	22
1978	14	6	-	1	21
1979	13	6	-	2	21
1980	12	6	-	2	20
1981	12	6	-	2	20
1982	12	6	-	2	20
1983	13	6	-	2	21
1984	13	6	-	2	21
1985	13	6	-	2	21
1986	12	6	-	2	20
1987	11	4	-	2	17
1988	8	4	-	-	12

TAB. I - Size and tonnage composition of tuna purse seiners fleet during the years 1971 to 1988.

YEAR	CATCH (MT)	EFFORT (days)	CPUE (MT)
1972	1.020	184	5,54
1973	1.225	216	5,67
1974	3.120	490	6,37
1975	4.170	532	7,84
1976	4.120	646	6,38
1977	4.179	770	5,43
1978	2.100	525	4.00
1979	2.855	819	3,40
1980	3.361	580	5,84
1981	1.712	480	3,57
1982	2.182	780	2,80
1983	2.560	588	4,35
1984	2.476	798	3,10
1985	1.453	735	1,98
1986	1.082	600	1,80
1987	557	326	1,71
1988	334	264	1,27

TAB. II - Historical series of catch, effort and CPUE of the bluefin tuna fishing by purse seiners in South Tyrrhenian.

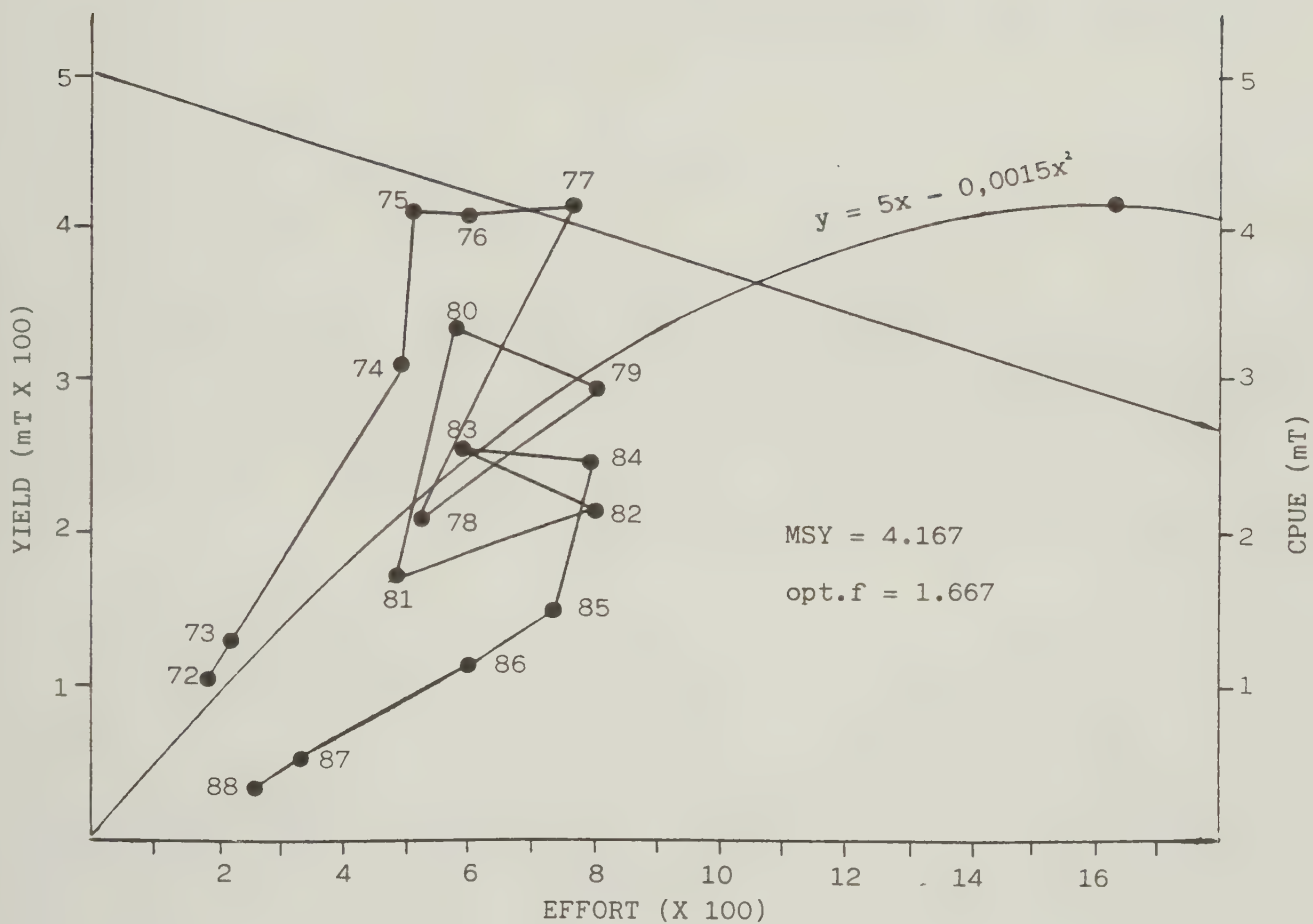


Fig. 1 - Yield and effort of purse seine tuna fishing in South Tyrrhenian during the years 1972 to 1988, and the SCHAEFER equilibrium curve.

ASPETTI BIOLOGICI DI XIPHIAS GLADIUS L.1758 DEI MARI MERIDIONALI ITALIANI

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RIASSUNTO

Il pescespada (Xiphias gladius L. 1758), rappresenta una risorsa di pesca importante tale da rendere necessaria un'attuale valutazione delle risorse disponibili. In questo lavoro, iniziato nel 1984 e finanziato anche con contributo del Ministero della Marina Mercantile, riportiamo i risultati riguardanti alcuni aspetti biologici della specie rilevati su individui pescati nel Tirreno Meridionale.

SUMMARY

The swordfish (Xiphias gladius L.1758) is a very important species for italian fisheries and a detailed knowledge of the biology of the species is necessary for resources management. This paper presents the results of research started in 1985 with the financial support of the Ministero Marina Mercantile , concerning some biological aspects of the species, from specimens collected in the Southern Tyrrhenian Sea.

Materiali e metodi

Lo studio dell'accrescimento dei giovani è stato effettuato su individui catturati nel basso Tirreno e nello Jonio tra agosto del 1987 ed aprile del 1988; per la loro cattura si è utilizzato un palangrese derivante di superficie.

In totale sono stati campionati 118 individui giovani appartenenti al gruppo d'età zero; su ognuno è stata rilevata la lunghezza alla forca LJFL in cm ed il peso eviscerato G in Kg; sono state prelevate le gonadi per le analisi istologiche.

Gli individui adulti campionati, provengono dalle aree limitrofe dello Stretto di Messina, dove vengono catturati, abitualmente tra i mesi di aprile e settembre di ogni anno, mediante pesca con l'arpione e con reti da posta derivanti (pescespadare).

Il lotto, su cui è stato effettuato lo studio, comprendeva 186 maschi e 213 femmine, estratti da un campionamento decisamente superiore. Per la determinazione dell'età sono state analizzate sezioni del secondo raggio della prima pinna dorsale e le ultime vertebre caudali (foto 1-2).

Risultati

Le osservazioni, eseguite sui preparati istologici delle gonadi di entrambi i sessi di giovani di Xiphias gladius, a partire dal quarto mese di vita e fino al decimo, hanno consentito di seguire le modificazioni delle cellule germinali.

Nelle gonadi femminili sono presenti ovociti di piccole dimensioni, tutti previtellogenetici (foto 3).

In quelle maschili sono evidenti varie fasi maturative.

Infatti, da una prevalenza iniziale di spermatogoni, alla fine del ciclo delle osservazioni, si sono evidenziati, all'interno dei lobuli, spermatociti primari e secondari (foto 4). Quanto sopra, fa presupporre che, mentre per le femmine sembra esclusa una sicura maturazione, nei maschi è possibile sopporla benchè non sia certo che si arrivi alla possibilità di emissione.

Per valutare l'accrescimento dei giovani è stata presa in considerazione la media delle lunghezze degli individui catturati nello stesso mese.

I valori sono riportati in tabella 1.

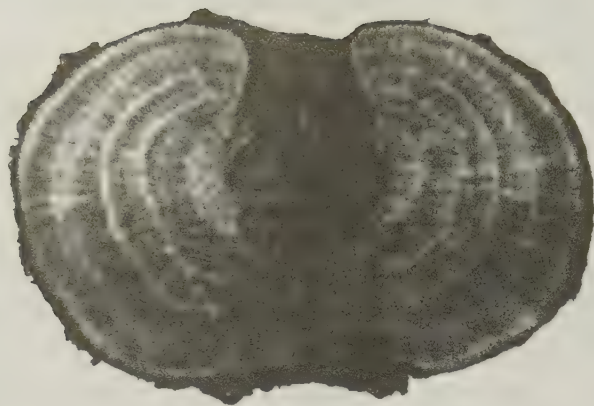


Foto 1 - Sezione trasversale del II° raggio della pinna dorsale di Xiphias gladius L. 1758. Individuo con LJFL di 166 cm.

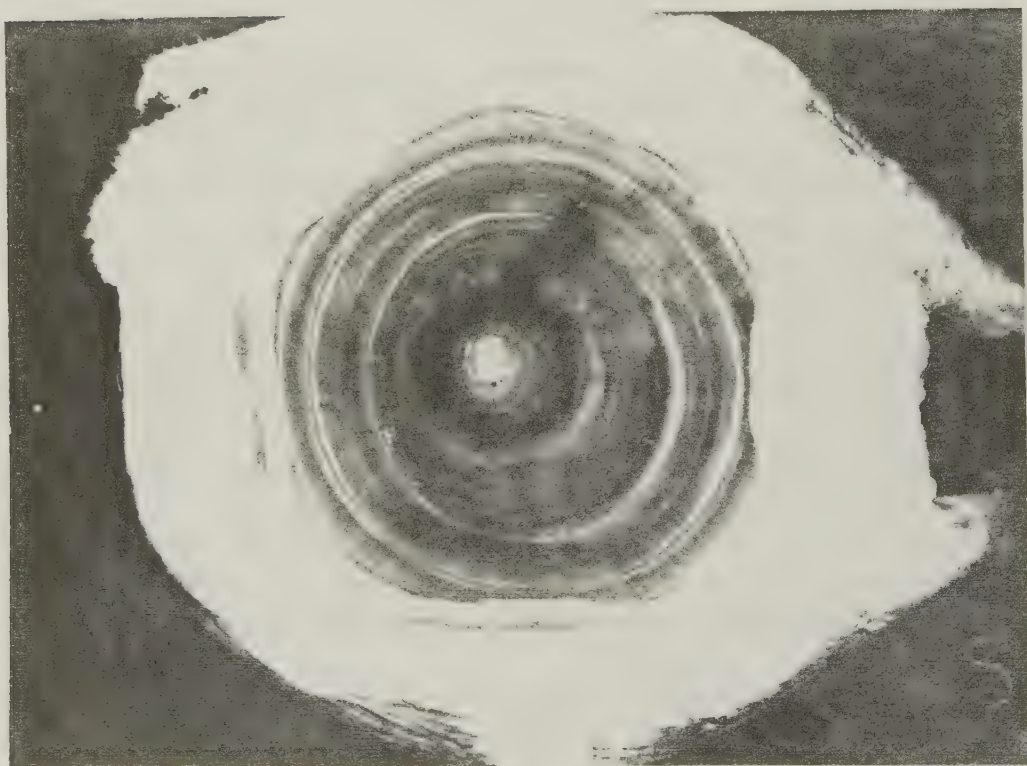


Foto 2 - Vertebra caudale dello stesso individuo.

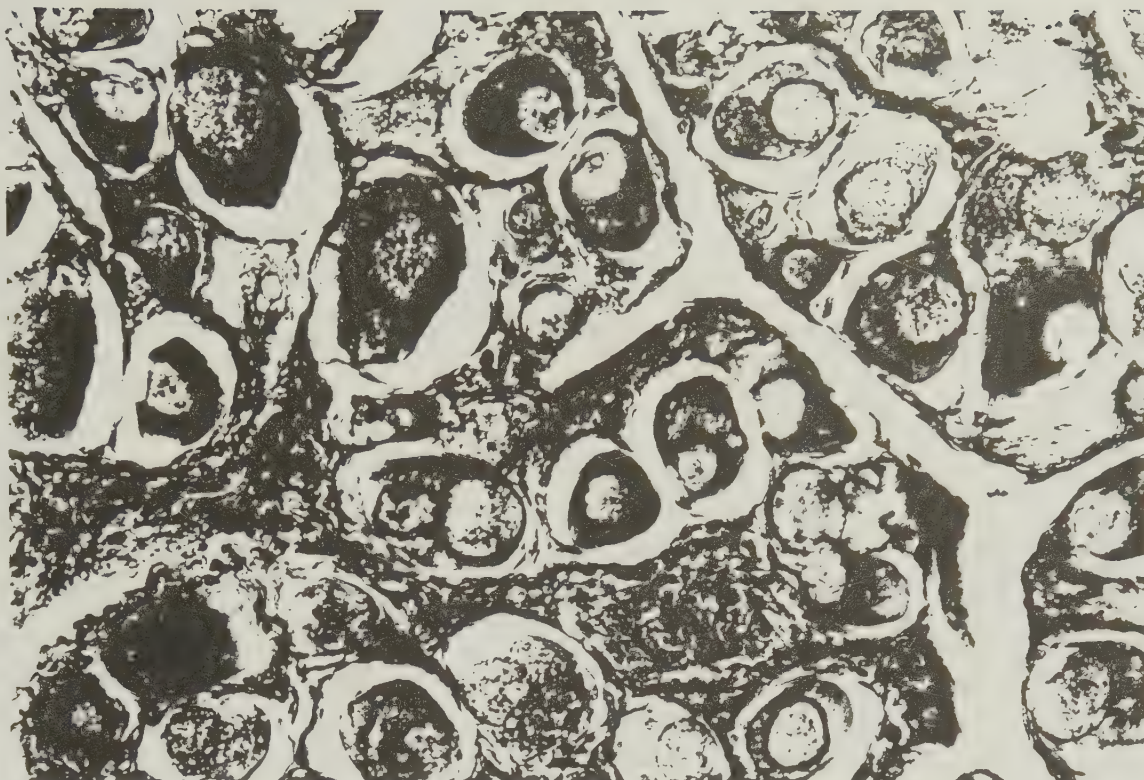


Foto 3 - Sezione trasversale di gonade femminile di Xiphias gladius L. 1758. Individuo con LJFL di 82 cm.

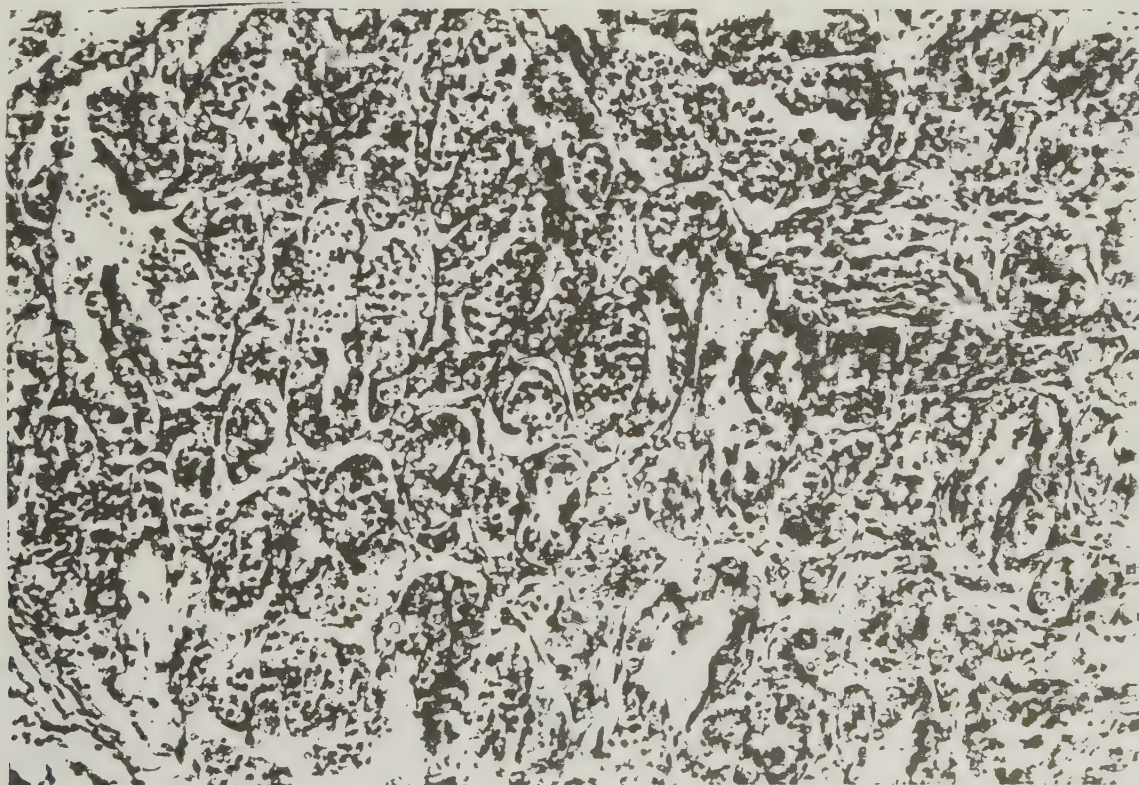


Foto 4 - Sezione trasversale di gonade maschile di Xiphias gladius L. 1758. Individuo con LJFL di 78 cm.

T A B E L L A 1

MESE	ETA'	LJFL	cm		N°	DEV.	LIM.FID	LJFL cm
CATTURA	MESI	MEDIA	MIN	MAX	IND	STAND	0.995	TEOR
luglio	(1)	(6.80)	----	----	--	---	----	6.80
agosto	(2)	22.10	----	----	1	---	----	34.58
settembre	(3)	54.62	46.3	60.0	9	5.02	+ 5.77	49.85
ottobre	(4)	59.76	52.0	66.0	35	3.44	+ 1.59	59.76
novembre	(5)	71.55	62.5	80.0	42	3.92	+ 1.65	66.14
dicembre	(6)	72.89	67.5	79.5	14	3.50	+ 2.90	71.00
gennaio	(7)	74.73	65.8	84.7	10	6.72	+ 7.10	74.73
febbraio	(8)	-----	-----	-----	--	-----	-----	77.61
marzo	(9)	76.60	73.2	80.5	4	3.28	+ 8.72	79.96
aprile	(10)	81.90	75.5	88.2	3	6.35	+26.22	81.90

In questa tabella, il valore di deviazione standard, relativo ad ogni classe, risulta abbastanza elevato in quanto gli individui nascono durante un periodo di tempo abbastanza lungo, tra giugno ed agosto e forse anche settembre (SELLA M. 1911, SANZO L. 1922, SCORDIA C. 1939, CAVALIERE A. 1963, HARATA T. et al.; 1980, MEGALOFONOU et al.; 1985, 1987). Nonostante ciò, abbiamo ritenuto opportuno valutare i tassi di crescita per avere un'indicazione sull'accrescimento dei giovani pescispada.

Per calcolare quest'accrescimento abbiamo utilizzato l'equazione di una curva logistica con asintoto inferiore non nullo (MUNAO' F., CEFALI A. 1981), già utilizzata con successo per gli stadi giovanili di altre specie (CEFALI A. 1981, CEFALI A., POTOSCHI A. 1982).

L'equazione ha la seguente formulazione:

$$LJFL_t = H_0 + H / (1 + K C^{\frac{t}{d}})$$

dove:

H_0 = limite inferiore di LJFL;

$H_0 + H / 1 + K$ = limite superiore di LJFL;

t = età in mesi, $t = 0$ (mese di giugno), $t = 1$ (mese di luglio), ecc.;

K, C = costanti;

d = coefficiente di tempo.

I campionamenti, eseguiti mensilmente, hanno reso possibile la valutazione dell'accrescimento della specie per i primi 10 mesi di vita. Per il calcolo dei valori dei parametri dell'equazione di crescita è stato necessario, vista la mancanza di dati in corrispondenza del primo mese di vita, attribuire a quest'età una lunghezza stimata di 6,80 cm. Tale attribuzione di taglia-età scaturisce dalla constatazione che PADOA (in LO BIANCO, 1931-1956) riporta le dimensioni di 17,9 cm per un individuo pescato e descritto da Lo Bianco nel 1909 e di un altro di 30 cm entrambi catturati nelle stesse aree nel mese di agosto; pertanto, valutando i dati rilevati per le età successive è attendibile la dimensione da noi attribuita al mese di luglio.

Per la determinazione dei parametri dell'equazione abbiamo utilizzato i valori di età-lunghezza media (tab 1) relativi al mese di luglio, ottobre, gennaio ed aprile che hanno fornito i seguenti valori:

$$\begin{aligned} H &= -11,62 \\ H_0 &= 108,86 \\ K &= -0,88 \\ C &= 0,863 \\ d &= 0,333 \end{aligned}$$

La rappresentazione grafica dell'accrescimento teorico ottenuto è riportato in fig.1 ed è confrontato con i valori medi dell'accrescimento rilevati. I valori di crescita ottenuti non sono statisticamente molto significativi ma sono comunque indicativi e l'equazione riesce a quantificare con una certa fedeltà l'andamento dell'accrescimento.

La relazione intercorrente tra il peso (G) e la lunghezza (LJFL) è definita generalmente dall'equazione $G = a \cdot LJFL^b$.

Per il calcolo delle costanti a e b dell'equazione, relativamente ai giovani, abbiamo utilizzato il metodo dei minimi quadrati che, applicato a tutti i valori di peso-lunghezza, riassunti in tabella 2, ha dato i seguenti valori: $a = 4,14 \times 10^{-7}$ $b = 3,636$; $r = 0,887$. Osservando la rappresentazione grafica della relazione peso-lunghezza (fig. 2) si nota una notevole dispersione dei valori osservati attorno alla curva teorica. Infatti, il valore del coefficiente r dimostra una scarsa correlazione tra la lunghezza ed il peso che è da imputare ai differenti tassi di accrescimento temporale dei due parametri. In tabella 2 vengono riportati per ogni classe di LJFL di 1 cm, il valore medio di G rilevato, il numero degli individui, la deviazione standard, il G teorico ed i limiti fiduciari della media di G.

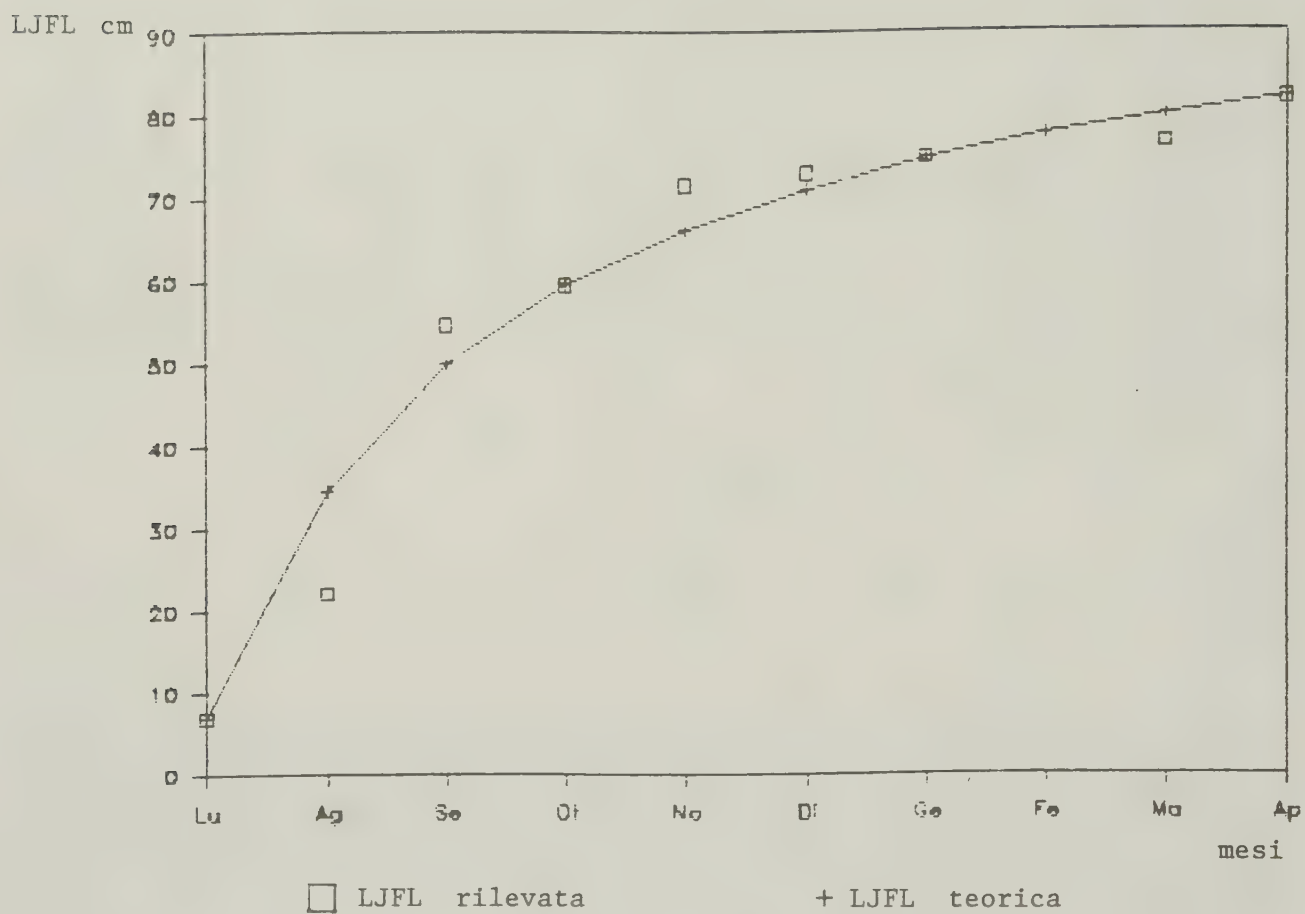


Fig. 1 - Accrescimento stadi giovanili di Xiphias gladius

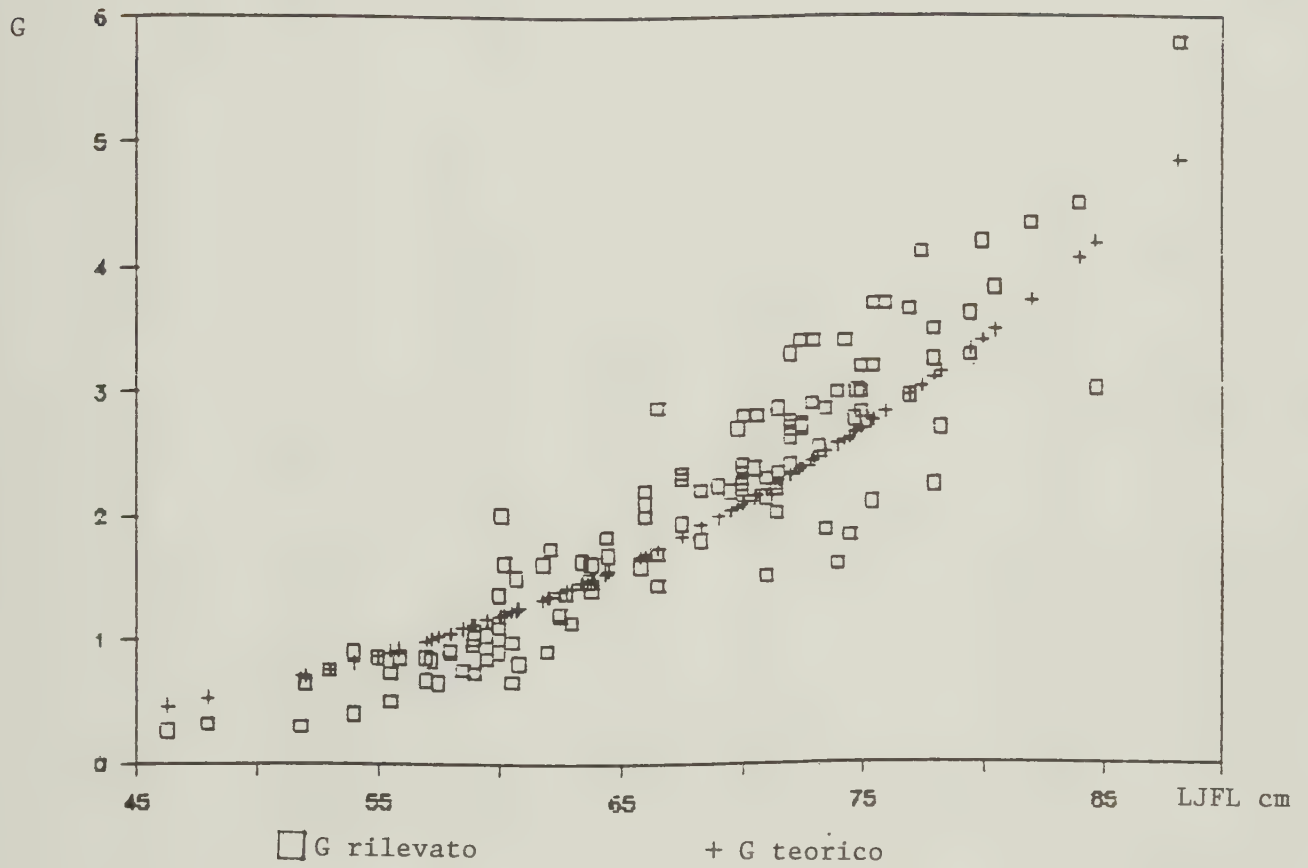


Fig. 2 - Relazione LJFL - G in giovani di Xiphias gladius

T A B E L L A 2

CLASSE LJFL cm	N° IND	G MED Kg	DEV ST	LIMITI FID 0.995	G TEOR
22	1	0.18	---	---	0.03
46	1	0.26	---	---	0,45
48	1	0.32	---	---	0.54
52	2	0.47	---	---	0.72
53	1	0.75	---	---	0.77
54	2	0.65	---	---	0.82
55	3	0.70	0.18	0.76	0.88
56	1	0.85	---	---	0.94
57	4	0.75	0.11	0.29	1.00
58	2	0.91	---	---	1.07
59	6	0.89	0.13	0.22	1.14
60	5	1.40	0.44	0.88	1.21
61	4	0.99	0.37	0.97	1.28
62	3	1.43	0.44	1.83	1.36
63	5	1.31	0.20	0.41	1.44
64	4	1.58	0.19	0.49	1.53
65	1	1.69	---	---	1.62
66	4	1.97	0.27	0.71	1.71
67	6	2.10	0.51	0.85	1.81
68	2	2.00	---	---	1.91
69	2	2.22	---	---	2.01
70	7	2.49	0.24	0.34	2.11
71	9	2.29	0.40	0.46	2.23
72	6	2.86	0.40	0.66	2.35
73	7	2.71	0.46	0.65	2.47
74	3	2.67	0.94	3.87	2.59
75	10	2.88	0.55	0.58	2.72
76	1	3.70	---	---	2.85
77	3	3.57	0.58	2.41	2.99
78	4	2.92	0.56	1.50	3.14
79	2	3.45	---	---	3.29
80	1	4.19	---	---	3.44
81	1	3.83	---	---	3.60
82	1	4.35	---	---	3.76
84	1	7.30	---	---	4.11
85	1	3.02	---	---	4.29
88	1	5.80	---	---	4.86

Per gli adulti, nelle figg.3-4 sono riportate le classi di frequenza percentuale degli individui maschi e femmine

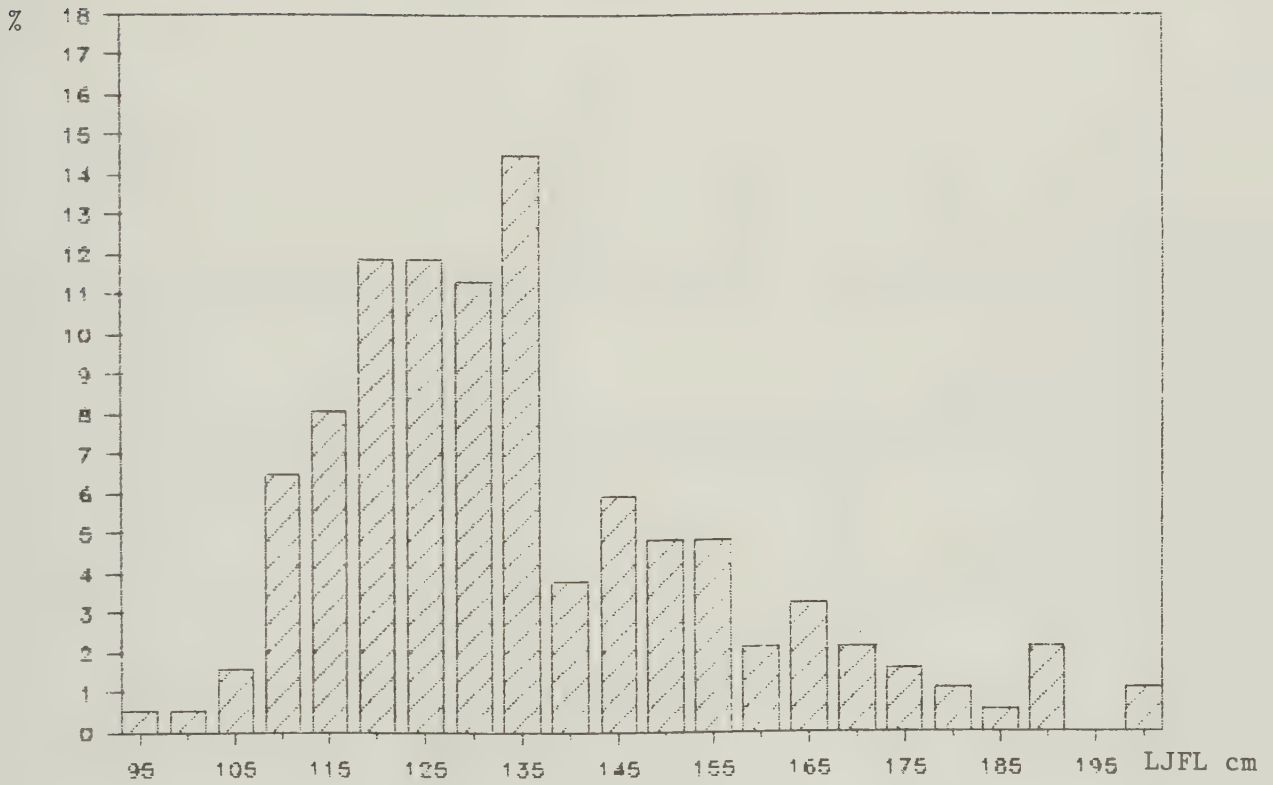


FIG. 3 - Frequenza percentuale di individui maschi di Xiphias gladius L.1758.

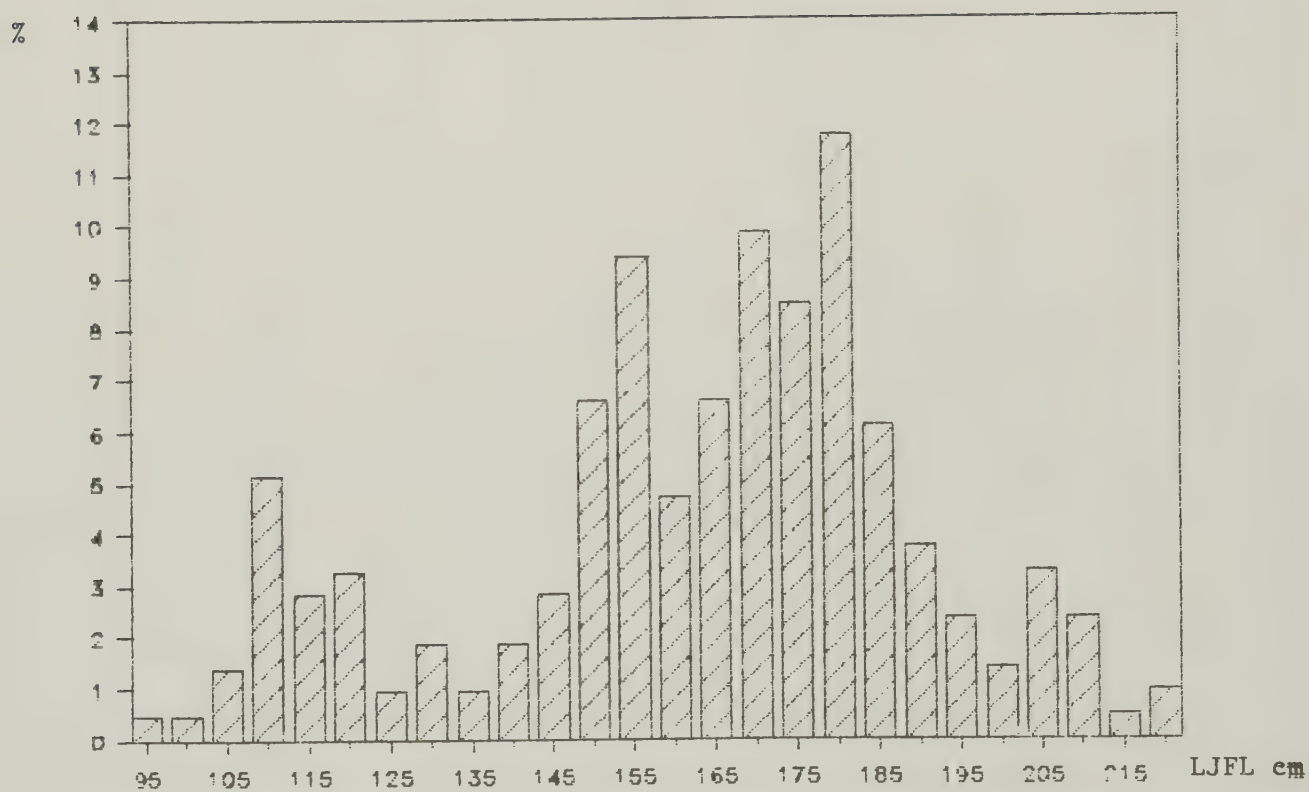


Fig. 4 - Frequenza percentuale di individui femmina di Xiphias gladius L.1758

campionati. I dati di età-lunghezza, relativamente agli adulti sono stati raggruppati, separatamente per i due sessi, in classi di età ottenendo la media della lunghezza per ogni classe considerata (tab.3).

T A B E L L A 3

MASCHI						FEMMINE					
ETA'	LJFL	IND.	DEV.	LJFL	LIM.FID.	LJFL	IND.	DEV.	LJFL	LIM.FID.	
ANNI	cm	N°	ST.	TEOR.	0.995	cm	N°	ST.	TEOR.	0.995	
** 1	110.6	25	6.65	104.9	+3.8	110.6	25	6.65	107.2	+ 3.8	
2	124.4	61	6.55	121.9	+2.3	127.7	12	8.50	127.2	+ 8.0	
3	133.9	49	6.69	138.0	+2.6	149.5	37	6.27	146.6	+ 2.8	
4	152.0	32	7.08	153.2	+3.5	167.0	56	6.97	165.3	+ 2.5	
5	167.7	8	5.20	167.6	+6.6	179.6	53	6.98	183.3	+ 2.7	
6	178.4	5	4.39	181.1	+8.9	198.0	26	10.44	200.8	+ 5.8	
7	191.0	5	4.47	193.9	+9.1	214.7	4	7.08	217.8	+23.9	
8	198.0	1	----	206.1	---	-----	--	----	-----	----	

** I valori di lunghezza-età relativi al primo anno sono identici per i due sessi non essendo stato possibile determinare il sesso.

Nella tabella 3 le classi di età più rappresentate sono la seconda, terza e quarta per i maschi mentre, per le femmine sono quelle di tre, quattro, cinque e sei anni.

La grande differenza tra il numero dei maschi e delle femmine appartenenti al secondo anno di età è certamente dovuto al sistema di campionamento che, eseguito durante il periodo riproduttivo della specie, seleziona nella cattura, come già rilevato da CAVALLARO et al.; (1986), e da MEGALOFONOU et al.; (1985, 1987).

I dati di lunghezza-età mostrano che i campioni sono in grado di rappresentare l'accrescimento della specie separatamente per i due sessi.

Per questo abbiamo utilizzato l'equazione di von Bertalanffy (1938):

$$LJFL_t = LJFL_{\infty} [1 - e^{-k(t-t_0)}]$$

i cui parametri ($LJFL_{\infty}$, k , t_0) sono direttamente utilizzati nella maggior parte delle statistiche di gestione degli stocks ittici.

Si è calcolato quindi il valore di $LJFL_{\infty}$, applicando ai dati di età-lunghezza della tabella 3 il "Ford-Walford plot" e, successivamente, utilizzando tutti i valori di età-lunghezza rilevati, sono stati calcolati i parametri k e t_0 , con la seguente equazione:

$$t_o = t + 1/k * \ln[(LJFL_{\infty} - LJFL_t)/LJFL_{\infty}]$$

I valori ottenuti, riportati in tabella 4, hanno permesso il calcolo delle lunghezze teoriche che sono inserite nella tabella 3.

T A B E L L A 4

PARAMETRO	FEMMINE	MASCHI
LJFL ∞ =	704,00	415,51
k =	0,034	0,056
Coeff.corr =	0,992	0,988
t _o =	-3,84	- 4,17

Gli elevati valori di LJFL ∞ di gran lunga superiori rispetto alle taglie massime campionate, indicano che l'accrescimento è caratterizzato da incrementi quasi costanti per le classi di età-lunghezza da noi considerate (maschi fino ad otto anni e 198 cm LJFL, femmine fino a sette anni e 215 cm LJFL) e quindi l'accrescimento, per l'arco di tempo considerato, è graficamente rappresentato da una linea quasi retta.

Nel confrontare l'accrescimento in lunghezza nei due sessi, rappresentato graficamente in fig.5, risulta evidente che gli incrementi annuali sono costantemente maggiori nelle femmine, per cui queste, a parità di età, sono più lunghe dei maschi.

La relazione intercorrente tra il peso e la lunghezza ($G=a*LJFL^b$) ha dato i seguenti valori:

$$\begin{aligned} \text{MASCHI : } G &= 4.621 * 10^{-6} * LJFL ^ 3.208 & r &= 0.965 \\ \text{FEMMINE: } G &= 2.102 * 10^{-5} * LJFL ^ 2.913 & r &= 0.966 \end{aligned}$$

Nelle figg. 6 e 7 vengono riportati graficamente gli andamenti delle relazioni peso-lunghezza nei due sessi. Dal confronto, si evince che, a parità di lunghezza le femmine pesano meno dei maschi.

Il minor peso delle femmine potrebbe essere dovuto oltre che al dimorfismo sessuale, come è stato precedentemente rilevato nell'accrescimento in lunghezza, anche al particolare metabolismo dipendente dallo stato fisiologico al momento della cattura. Infatti, è possibile che molte femmine campionate abbiano metabolizzato e parzialmente utilizzato tessuti somatici a favore dell'accrescimento degli ovociti (ROFF 1983).

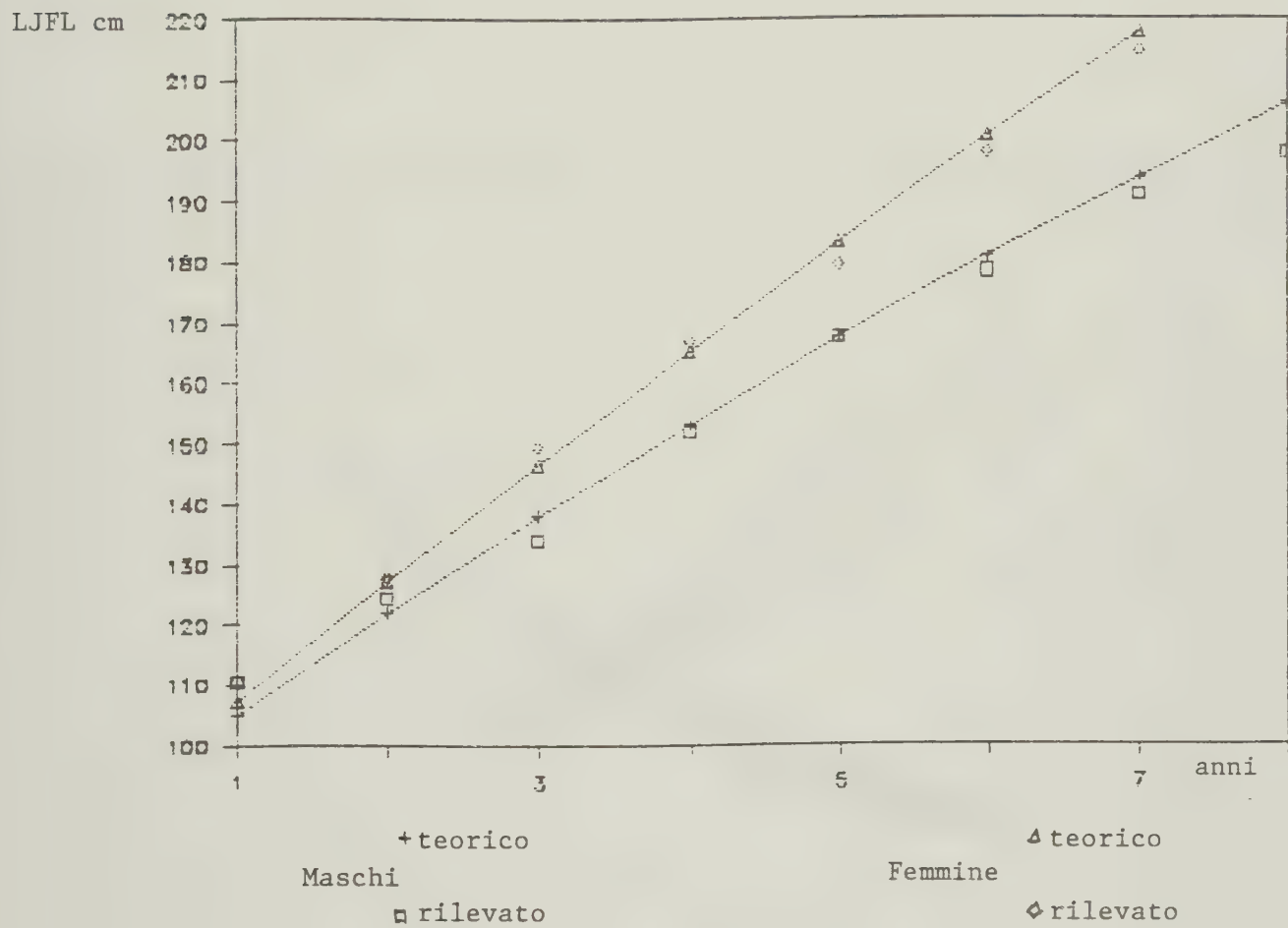


Fig. 5 - Accrescimento adulti di Xiphias gladius

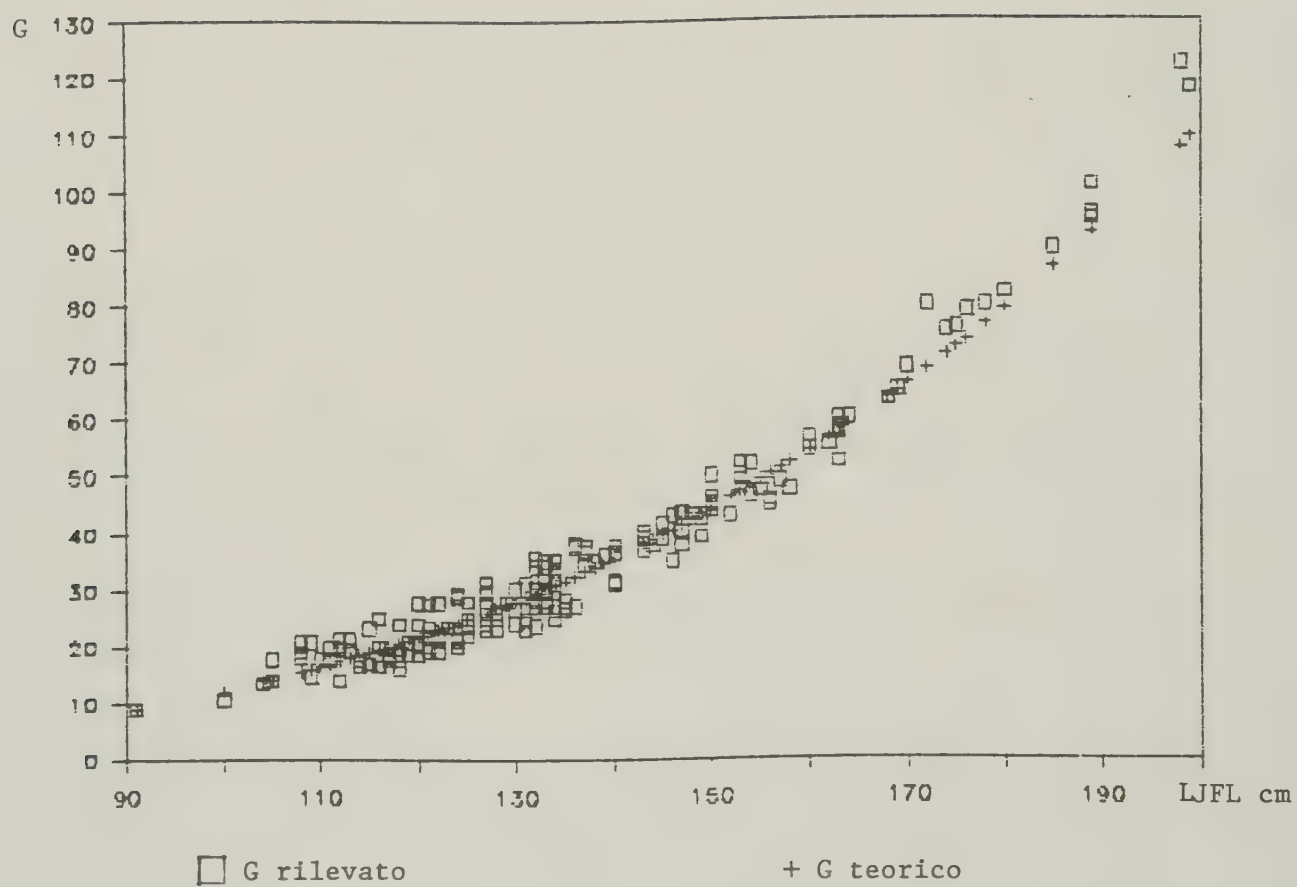


Fig. 6 - Relazione LJFL - G maschi

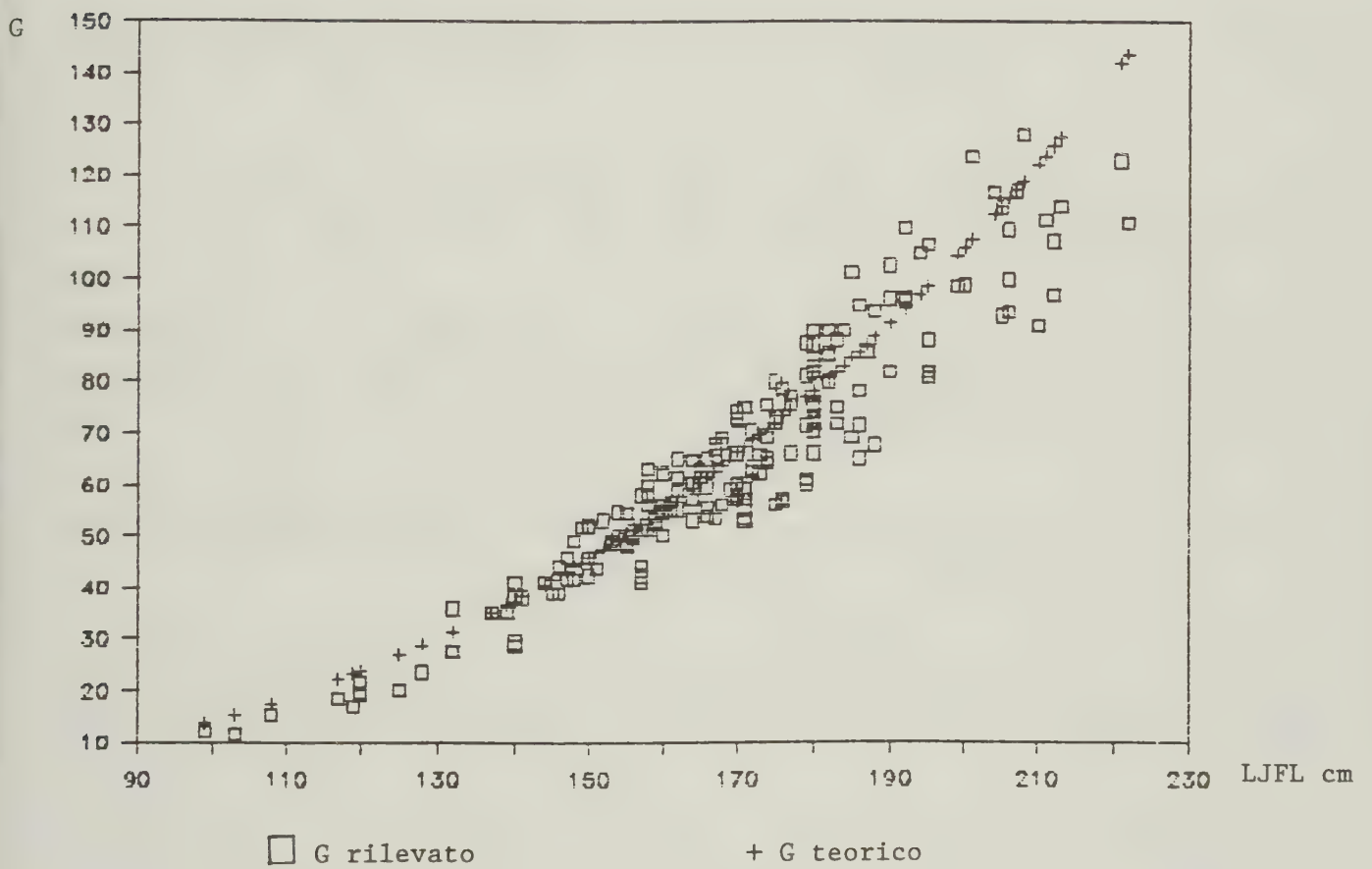


Fig. 7 - Relazione LJFL - G femmine

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BLUEFIN TUNA (*Thunnus thynnus* L.) AND ALBACORE (*Thunnus alalunga* Bonn.) FISHERY IN THE SOUTHERN TYRRHENIAN SEA: 1985-1989 SURVEYS.

by

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Key words: bluefin tuna, albacore, Tyrrhenian Sea, length classes.

ABSTRACT

A brief report on the bluefin tuna and albacore fishery in the southern Tyrrhenian Sea in the years 1985-1989 is here reported, with a short description of the fisheries.

CPUE data are available only for 1985 and 1986 and length-class analysis has been carried out for the whole period for all the gears together, except the purse seine.

THE BLUEFIN TUNA FISHERY

The bluefin tuna (*Thunnus thynnus* L.) fishery is one of the most ancient and typical in the Mediterranean.

The most traditional fishery is the historical "tonnara", a tuna trap known since the fifth century B.C. (SARA', 1975; CONSOLO, 1987), but now none of them is still active in the southern Tyrrhenian Sea: the last one was in Scopello, near Palermo, but it was closed in 1984; however, the same tuna trap has been used in Punta Raisi (also near Palermo) in 1985 (DI NATALE *et al.*, 1990).

Now the commercial catches are mostly from the purse-seine fleet, which operates in the southern Tyrrhenian Sea during spring and summer and in the Ligurian Sea in autumn (ARENA *et al.*, 1981; ARENA, 1989).

A minor portion of the commercial catches in the southern Tyrrhenian Sea is made by other minor fishery activities: surface drift-nets, surface drifting long-lines and harpoons.

The surface drift-nets used for catching bluefin tuna have a small mesh size (from 6 to 8 cm) and they are commonly called "bisantonare", because it is possible to catch tunas and tuna-like fishes such as bonito ("biso"); these nets are used only by small artisanal boats along the northern coast of Sicily. Other drif-nets have a larger mesh size, from 8 to 18 cm, and they are called "alalungara", because are used for catching tuna and albacore. Bluefin tunas are also a by-catch in the swordfish drifnet fishery.

Surface drifting long-lines have often small hooks (no. 6 to 7 or no. 15 to 17), because they are used to catch juvenile tunas; typical drifting long-lines for catching tuna are used by some Japanese, Taiwanese and Korean boats which operate in the southern Tyrrhenian Sea in spring, but the catches are not reported.

Hand lines are very common in the Strait of Messina, where there is a large fleet (over 100) of small artisanal boats.

Bluefin tuna is also a target species for the characteristic boats of the Strait of Messina (called "passerelle" or "feluche") which still use the harpoon for catching bluefin tuna and swordfish.

A very accurate CPUE data series exists for the purse-seine fleet (ARENA, 1989), but CPUE data for all the other gears are extremely poor: a two-year (1985-1986) CPUE data series is available only for the harpoon (DI NATALE *et al.*, 1987), because CPUE data for other gears are related to by-catch.

Harpoon CPUE data are the followings (parameters: C = catches in kg; E = average fishing days):

CPUE 1985 = 70,80

CPUE 1986 = 49,19.

Some more detailed information is available on the length frequency of the age classes, from a research programme sponsored by the Italian Ministry of Merchant Marine (Law no. 41/82) in 1984-1986. The sampling points were Lipari, S. Agata Militello, Milazzo, Messina, Ganzirri and Vibo Marina; after 1986, the research was carried out by Aquastudio, using private funds and with a reduction in the number of sampling points (Milazzo, Messina and Ganzirri).

Weighted mean length was the follows:

year	1985	1986	1987	1988	1989
cm	78,7	119,3	51,7	70,6	82,2

However, these data are heavily influenced by the affluence of juveniles close to the coast, in area where the small boats are able to fish; they are of limited value for stock-assessment purposes.

The length-frequency graphs for the last five years (Fig. 1 to 5) shows clearly a very high percentage of juveniles in all the years (peaks at 40 cm in 1985, at 45 cm in 1986, at 35 cm in 1987, at 30 cm in 1988 and at 35 cm in 1989), largely due to the strong influence of illegal fishing. The graphs for age classes over 1 are quite different from the graphs reported by ARENA (1989), but this is due to the fact that catches by all gears combined are made throughout the year. Nevertheless, the graph shown by ARENA *et al.* (1980) for the southern Tyrrhenian Sea is not so different from the graphs shown here for the last five years.

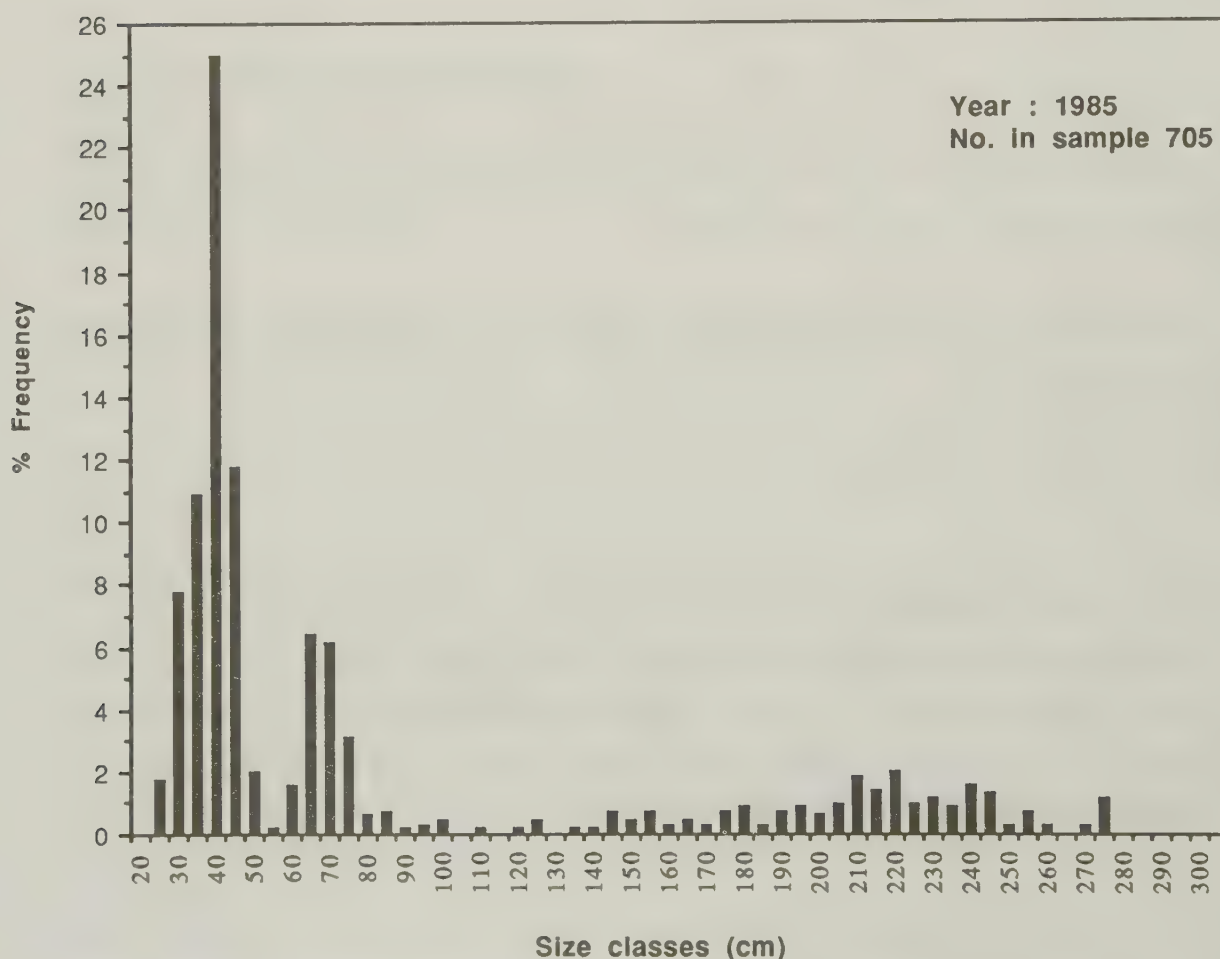


Fig. 1 - Length frequency distribution of bluefin tuna in the southern Tyrrhenian Sea in 1985

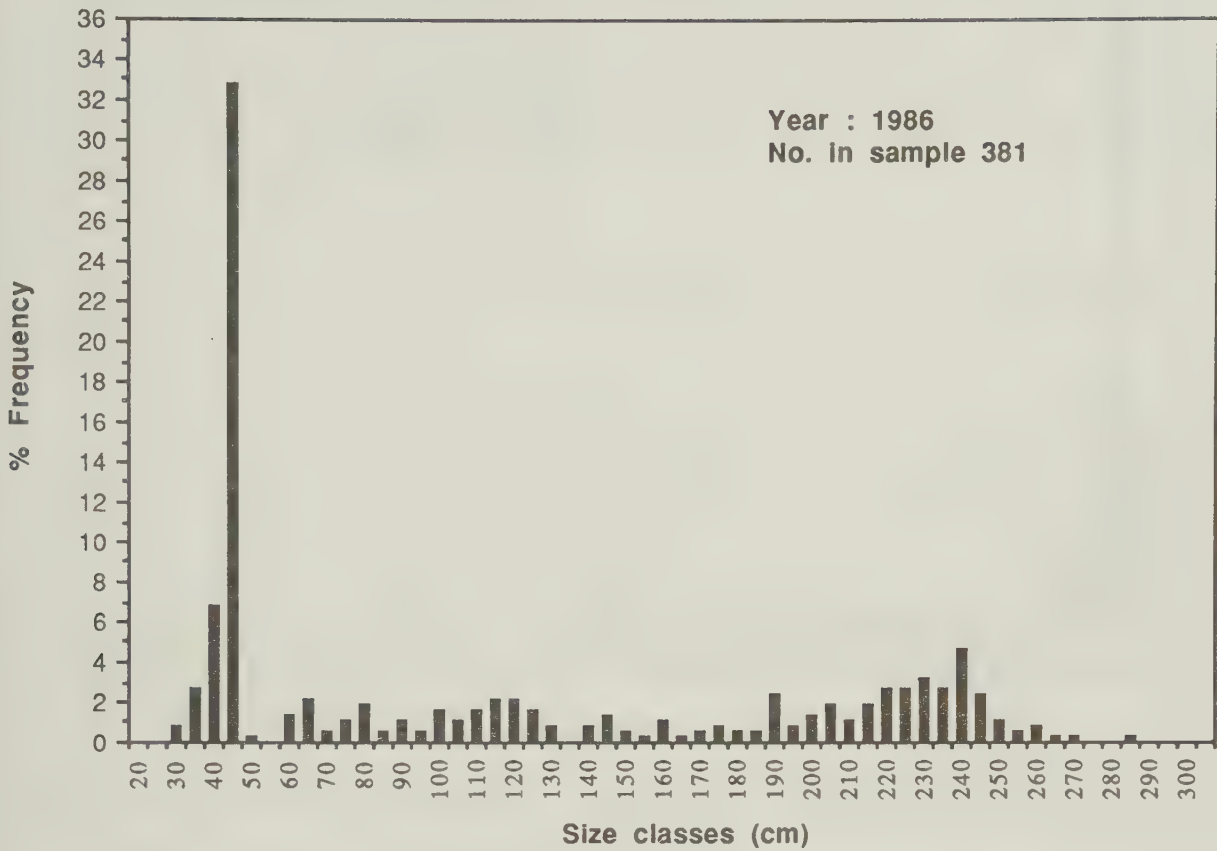


Fig. 2 - Length frequency distribution of bluefin tuna in the southern Tyrrhenian Sea in 1986

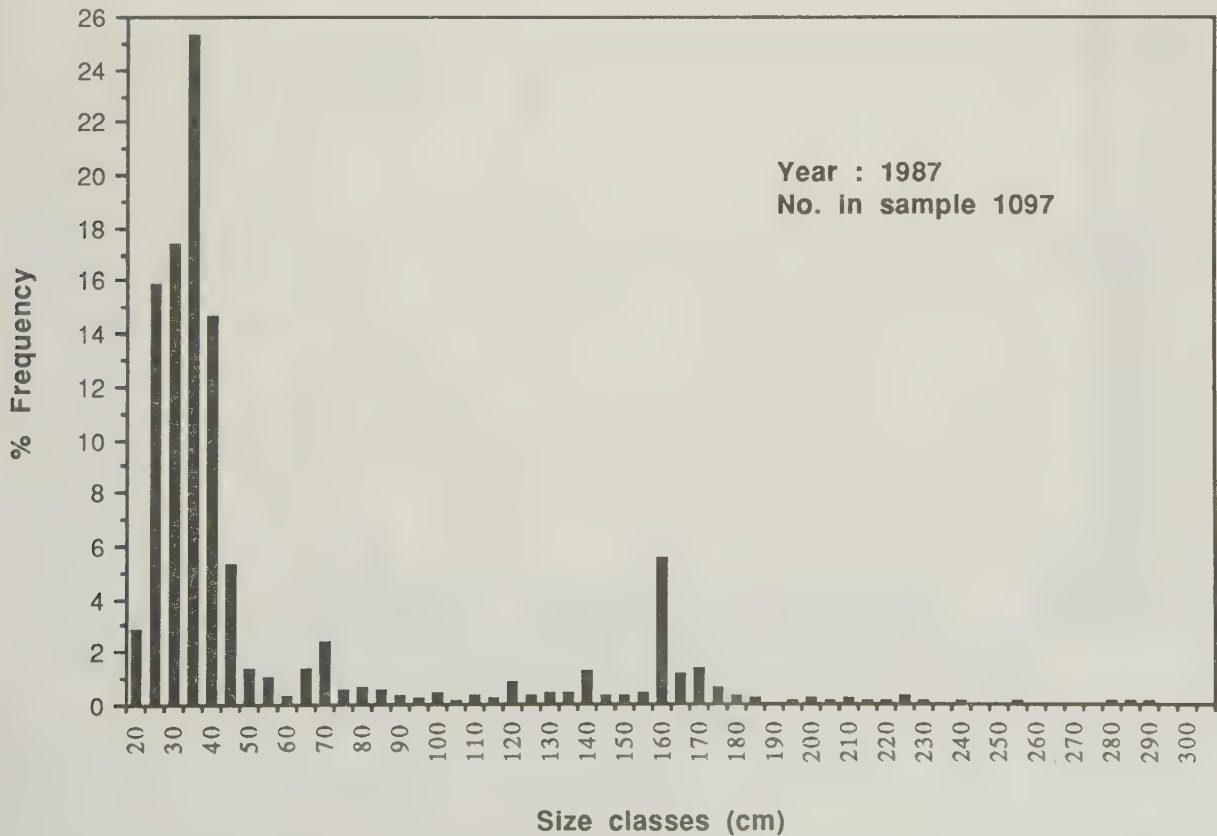


Fig. 3 - Length frequency distribution of bluefin tuna in the southern Tyrrhenian Sea in 1987

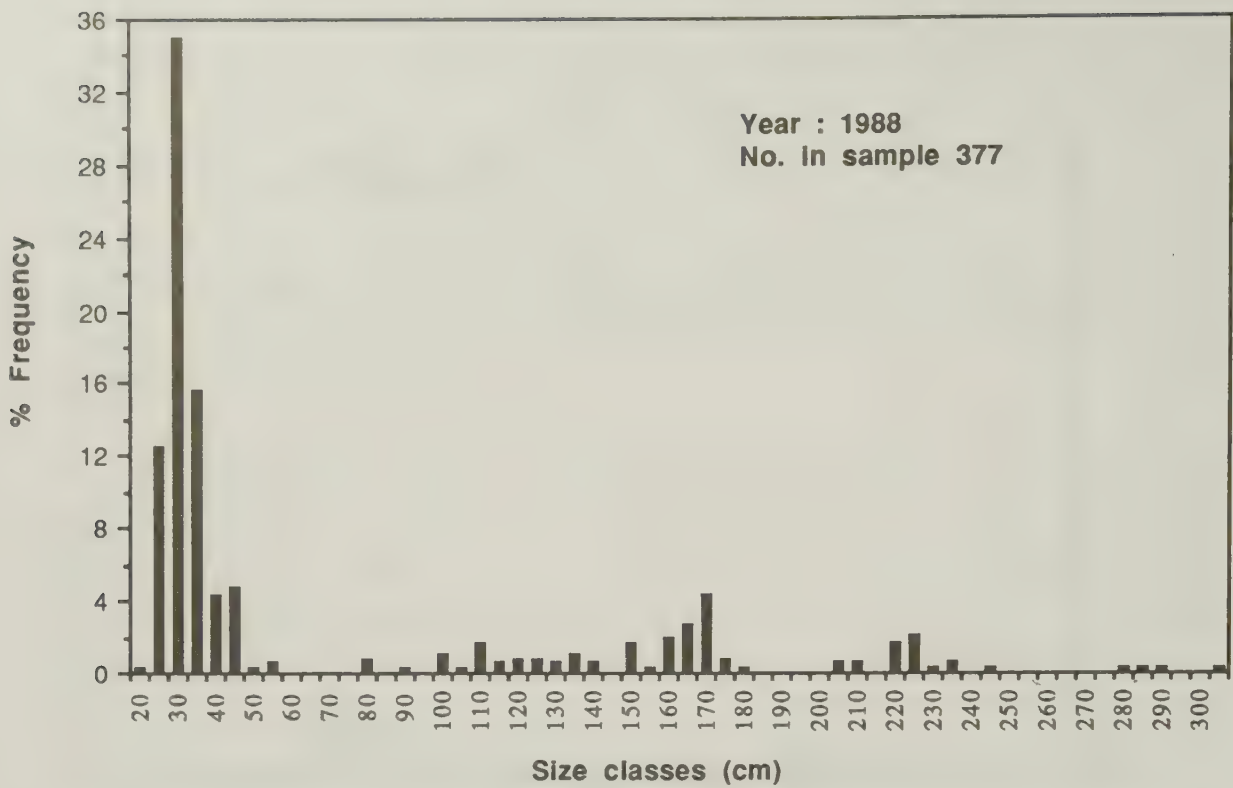


Fig. 4 - Length frequency distribution of bluefin tuna in the southern Tyrrhenian Sea in 1988

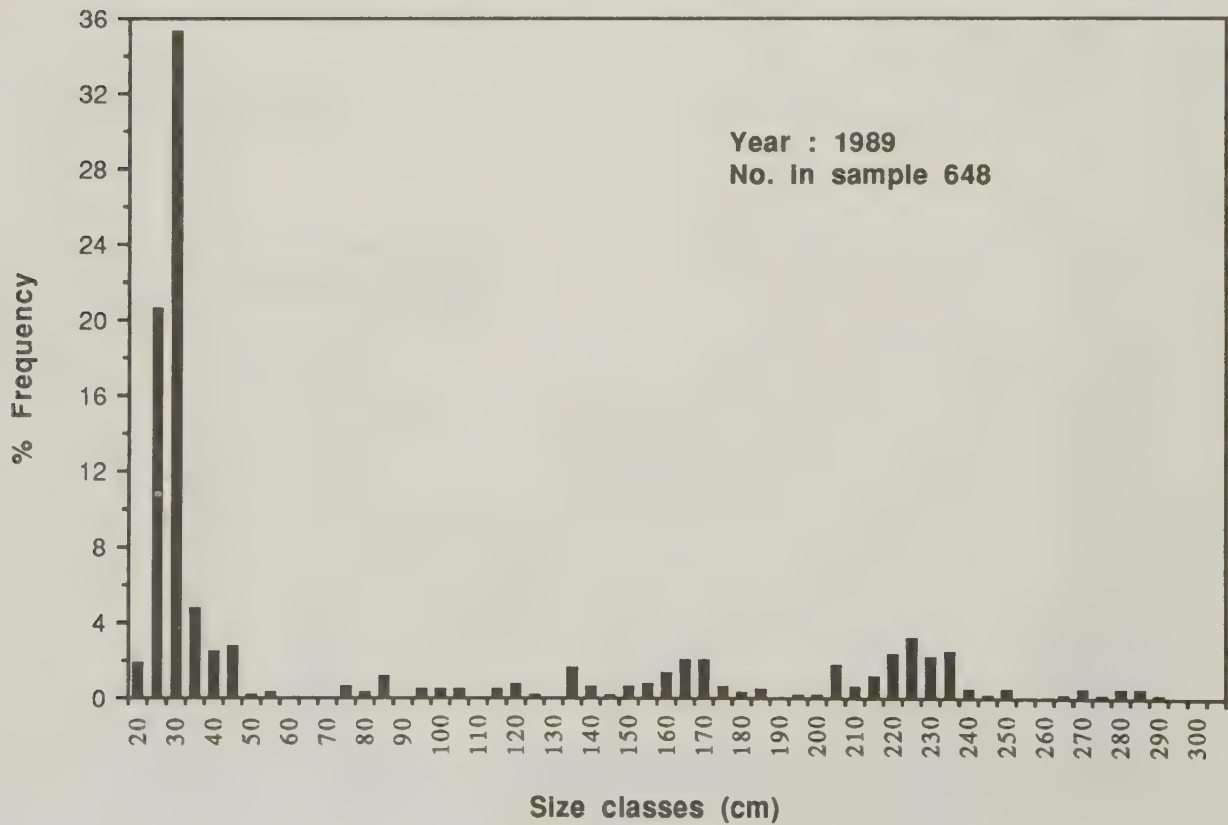


Fig. 5 - Length frequency distribution of bluefin tuna in the southern Tyrrhenian Sea in 1989

THE ALBACORE FISHERY

The albacore (*Thunnus alalunga* Bonn.) fishery in the southern Tyrrhenian Sea is certainly more recent than other fisheries but this species is of economic importance in spring and autumn.

Surface drift-nets, surface drifting long-lines and hand lines are commonly used for albacore fishing in this area.

Surface drift-nets often have albacore as a target species, mostly in spring and autumn, when the fleet uses medium-size mesh and the net is called "alalungara" or "palamitara". Albacore also represents an important by-catch of the swordfish fishery.

Surface drifting long-lines (with medium hooks) have albacore as a target species, mostly in the Aeolian Isles, but a very high by-catch of juvenile swordfish has been reported (DI NATALE *et al.*, 1987).

Hand lines are used in the Isle of Lipari with about the same technique as "pole and line", sometimes with very important catches.

CPUE data are available for 1985 and 1986 (DI NATALE *et al.*, 1987):

- surface drit-nets (parameters: C = catches in kg; E = (net length/100 m) x number of days fished):

CPUE 1985: 6,76

CPUE 1986: 3,05

- surface drifting long-line (parameters: C = catches in kg; E = (number of hooks/100) x fishing days; ASWLL = surface swordfish drifting long-line with big hooks; ALBLL = surface albacore drifting long-line):

CPUE 1985: ASWLL 6,76; ALBLL 13,65

CPUE 1986: ASWLL 3,05; ALBLL 5,25

- hand lines (parameters: C = catches in kg; E = fishing days):

CPUE 1985 = 255,47

CPUE 1986 = 36,14.

CPUE data in 1986 were affected by bad weather conditions in autumn.

Length sampling was carried out from January to December of each year in the same places as bluefin tuna: Lipari, S.Agata Militello, Milazzo, Messina, Ganzirri and Vibo Marina in 1985 and 1986 (with a grant of the Ministry of Merchant Marine, law no. 41/82); after 1986 the research was carried on by Aquastudio, using private funds, in Milazzo, Messina and Ganzirri.

Weighted mean lengths were as follows:

year	1985	1986	1987	1988	1989
cm	74,9	75,1	75,3	74,7	74,2

Figures 6 to 10 show peaks at 65 cm (1985, 1988 and 1989) and at 70 cm (1986 and 1987). None of the graphs show cohorts clearly. On the other hand, ARENA *et al.* (1980) obtained a graph in which modal length classes were really clear, but they used only 3-month sampling.

Furthermore, in recent years, several very large albacore have been reported in the southern Tyrrhenian Sea: a 36-kg specimen was captured near the Aeolian Isles in 1985; specimens over 22 kg are also reported in 1985, 1986 and 1989. Such fishes are quite unusual in the Mediterranean, but are more common in the Atlantic.

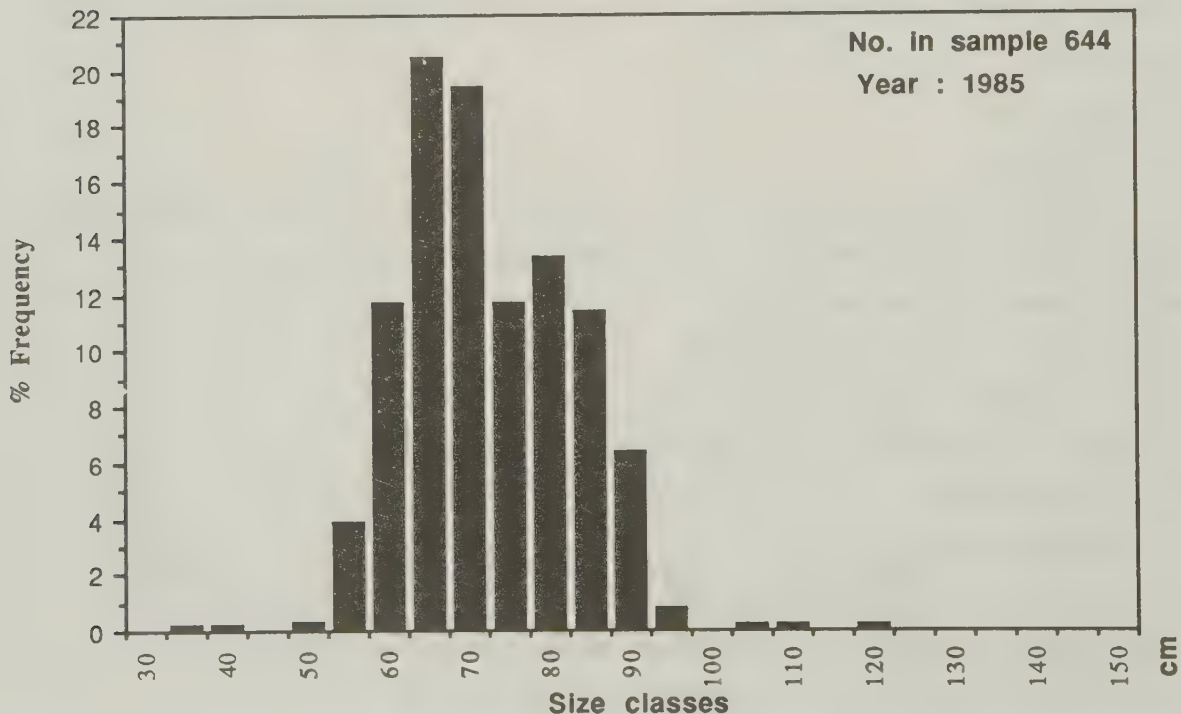


Fig. 6 - Length frequency distribution of albacore in the southern Tyrrhenian Sea

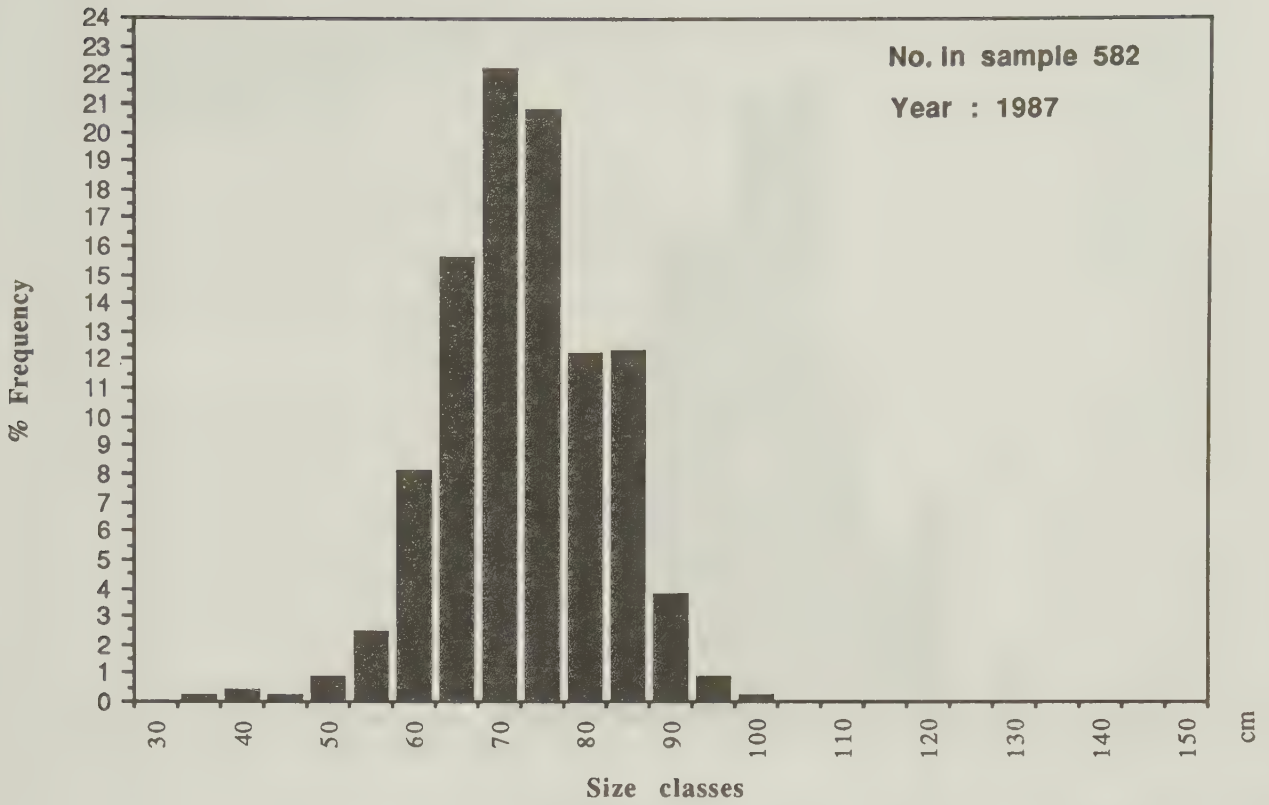


Fig. 8 - Length frequency distribution of albacore in the southern Tyrrhenian Sea

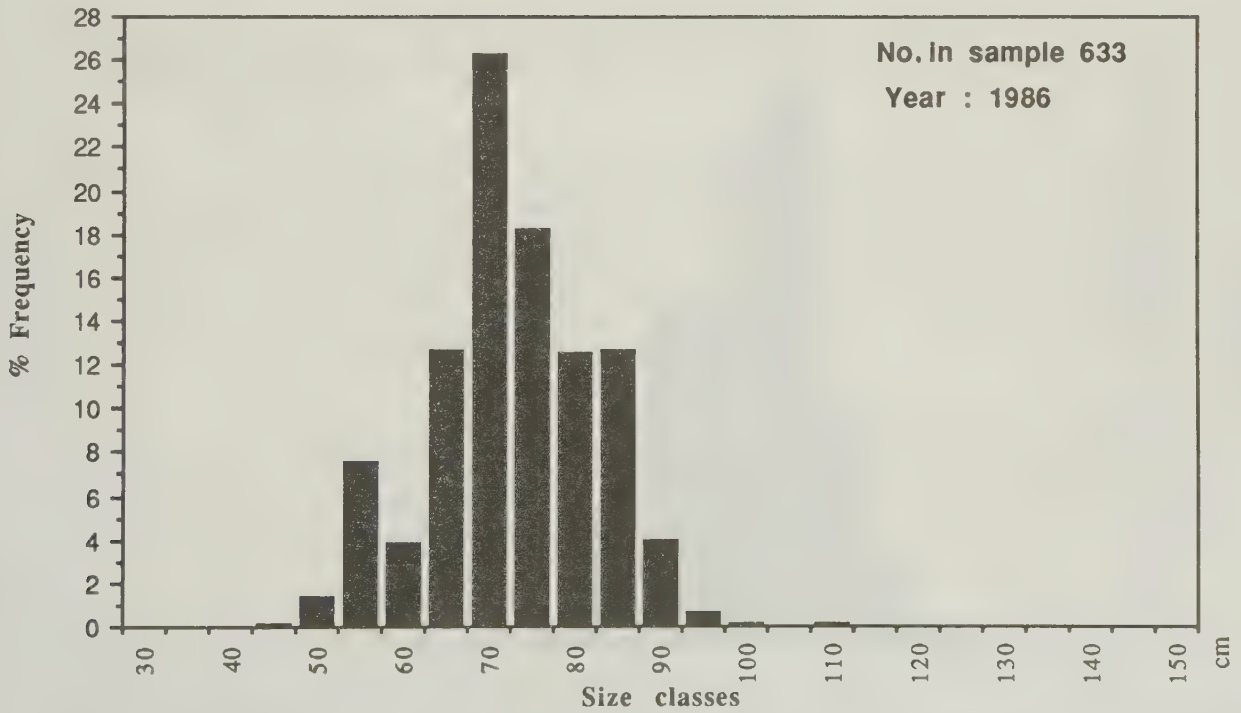


Fig. 7 - Length frequency distribution of albacore in the southern Tyrrhenian Sea

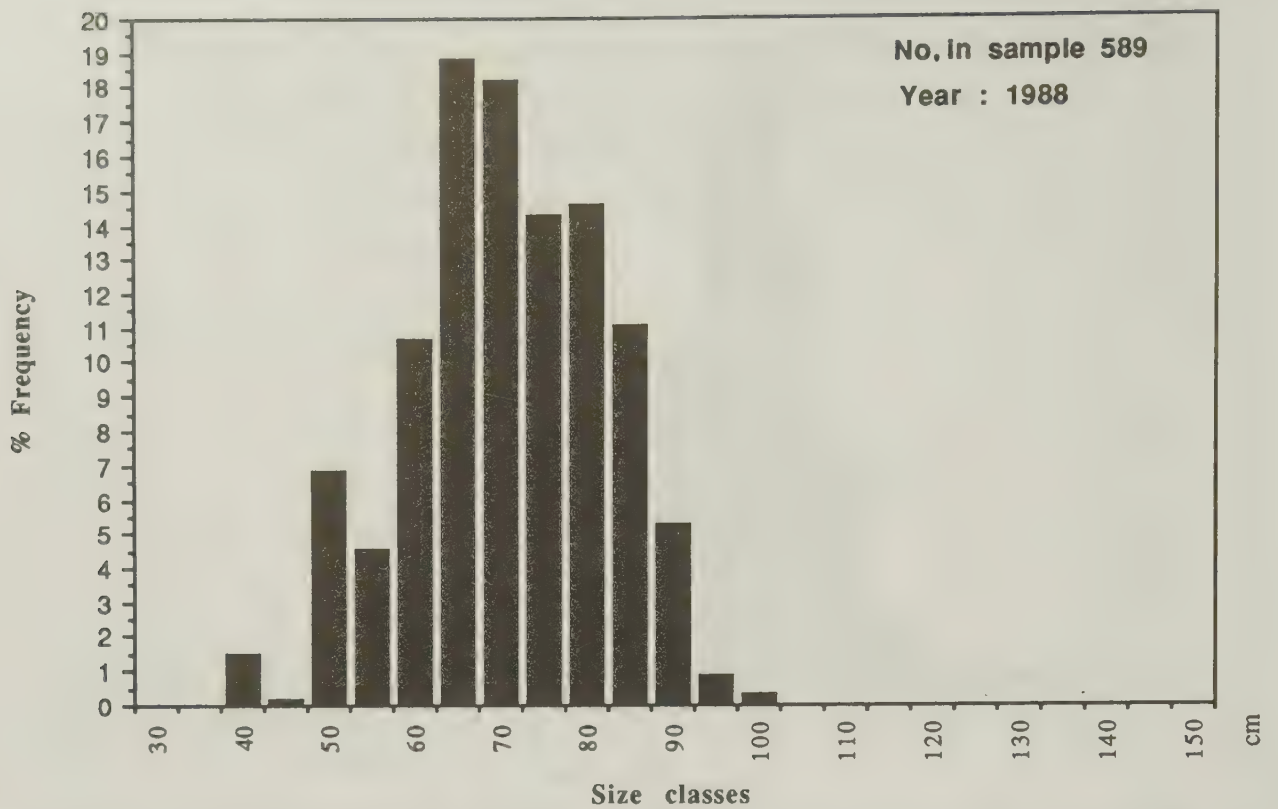


Fig. 9 - Length frequency distribution of albacore In the southern Tyrrhenian Sea

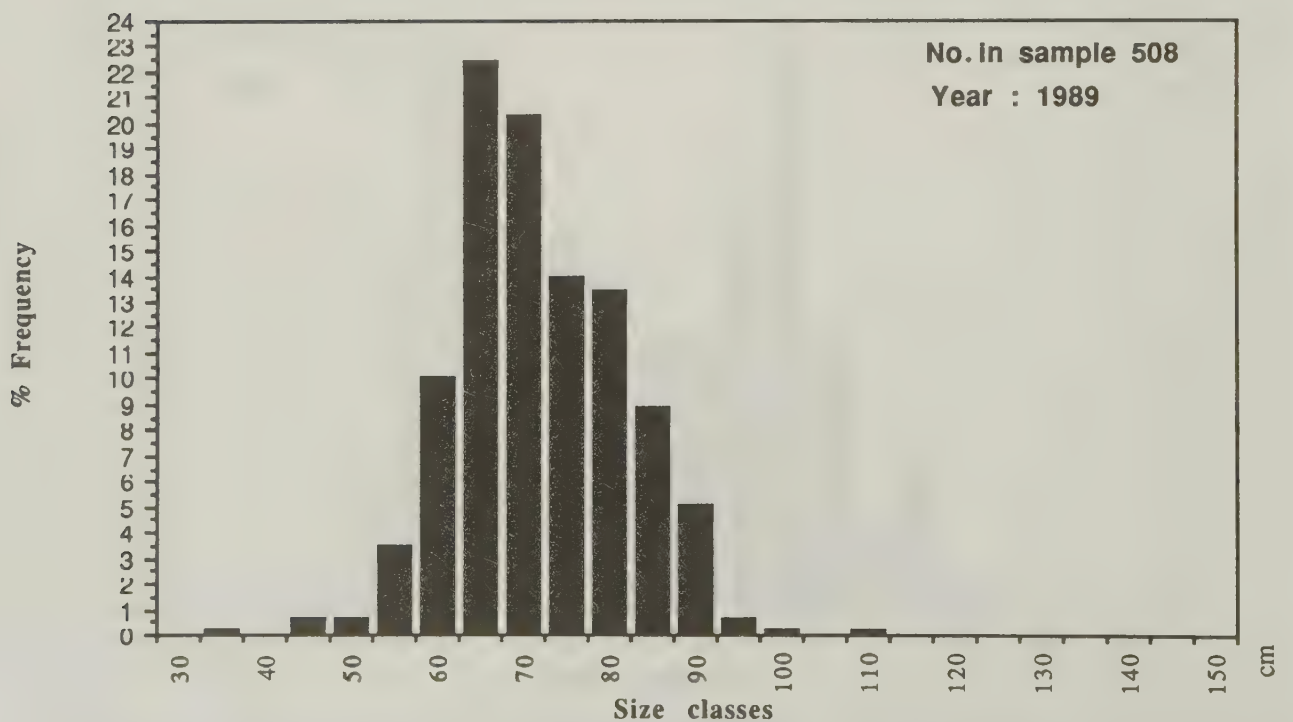


Fig. 10 - Length frequency distribution of albacore In the southern Tyrrhenian Sea

CONCLUSIONS

Bluefin tuna is clearly a species of marginal importance to the artisanal fishery, being more important for the purse-seine fleet (which should be considered as industrial) and for the tuna traps.

For the purse-seine, a very important reduction in CPUE and total catches has been shown (ARENA, 1989, DI NATALE *et al.*, 1990), owing to a complex of factors; for other gears, CPUE is not meaningful because of the short period of sampling.

Of course, the illegal high catches of juvenile specimens could affect the stock, also because this kind of fishery is well spread along all the Mediterranean coasts.

A more strict management of this species and the adoption of ICCAT minimum size regulation in all the Mediterranean Countries are important to maintain the resource.

On the contrary, the albacore stock seems stable and the mayor ishing effort is located only in certain areas (southern Tyrrhenian Sea and Jonian Sea).

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Table I- Length frequency of bluefin tuna fished by all different gears (except purse-seine) used by the Italian fleet in the southern Tyrrhenian Sea in the period 1985-1989.

AREA: Southern Tyrrhenian Sea (Mediterranean)

Species: BLUEFIN TUNA (*Thunnus thynnus*) BFL

Gear: all gears UNCL (except PS)

LENGTH CLASSES	1985		1986		1987		1988		1989	
	no.	%	no.	%	no.	%	no.	%	no.	%
20-24,9	0	0	0	0	31	2,83	1	0,27	12	1,85
25-29,9	12	1,70	0	0	174	15,86	47	12,47	133	20,52
30-34,9	54	7,76	3	0,79	191	17,41	132	35,01	229	35,34
35-39,9	77	10,92	10	2,62	277	25,25	59	15,65	31	4,78
40-44,9	176	24,96	26	6,82	160	14,59	16	4,24	16	2,47
45-49,9	83	11,77	125	32,81	58	5,29	18	4,77	18	2,78
50-54,9	14	1,99	1	0,26	14	1,28	1	0,27	1	0,15
55-59,9	1	0,14	0	0	11	1,00	2	0,53	2	0,31
60-64,9	11	1,56	5	1,31	3	0,27	0	0	0	0
65-69,9	45	6,38	8	2,10	15	1,37	0	0	0	0
70-74,9	43	6,10	2	0,52	26	2,37	0	0	0	0
75-79,9	22	3,12	4	1,05	5	0,46	0	0	4	0,62
80-84,9	4	0,57	7	1,84	7	0,64	3	0,80	2	0,31
85-89,9	5	0,71	2	0,52	5	0,46	0	0	7	1,08
90-94,9	1	0,14	4	1,05	3	0,27	1	0,27	0	0
95-99,9	2	0,28	2	0,52	2	0,18	0	0	3	0,46
100-104,9	3	0,43	6	1,57	4	0,36	4	1,06	3	0,46
105-109,9	0	0	4	1,05	1	0,09	1	0,27	3	0,46
110-114,9	1	0,14	6	1,57	3	0,27	6	1,59	0	0
115-119,9	0	0	8	2,10	2	0,18	2	0,53	3	0,46
120-124,9	1	0,14	8	2,10	9	0,82	3	0,80	5	0,77
125-129,9	3	0,43	6	1,57	3	0,27	3	0,80	1	0,15
130-134,9	0	0	3	0,79	4	0,36	2	0,53	0	0
135-139,9	1	0,14	0	0	4	0,36	4	1,06	10	1,54
140-144,9	1	0,14	3	0,79	13	1,19	2	0,53	4	0,62
145-149,9	5	0,71	5	1,31	3	0,27	0	0	1	0,15
150-154,9	3	0,43	2	0,52	3	0,27	6	1,59	4	0,62
155-159,9	5	0,71	1	0,26	4	0,36	1	0,27	5	0,77
160-164,9	2	0,28	4	1,05	6	5,47	7	1,86	8	1,23
165-169,9	3	0,43	1	0,26	12	1,09	10	2,65	13	2,01
170-174,9	2	0,28	2	0,52	15	1,37	16	4,24	13	2,01
175-179,9	5	0,71	3	0,79	7	0,64	3	0,80	4	0,62
180-184,9	6	0,85	2	0,52	3	0,27	1	0,27	2	0,31
185-189,9	2	0,28	2	0,52	2	0,18	0	0	3	0,46
190-194,9	5	0,71	9	2,36	0	0	0	0	0	0
195-199,9	6	0,85	3	0,79	1	0,09	0	0	1	0,15
200-204,9	4	0,57	5	1,31	2	0,18	0	0	1	0,15
205-209,9	7	0,99	7	1,84	1	0,09	2	0,53	11	1,70
210-214,9	13	1,84	4	1,05	2	0,18	2	0,53	4	0,62
215-219,9	10	1,42	7	1,84	1	0,09	0	0	7	1,08
220-224,9	14	1,99	10	2,62	1	0,09	6	1,59	15	2,32
225-229,9	7	0,99	10	2,62	3	0,27	8	2,12	20	3,09
230-234,9	8	1,13	12	3,15	1	0,09	1	0,27	14	2,16
235-239,9	6	0,85	10	2,62	0	0	2	0,53	16	2,47
240-244,9	11	1,56	18	4,72	1	0,09	0	0	3	0,46
245-249,9	9	1,28	9	2,36	0	0	1	0,27	1	0,15
250-254,9	2	0,28	4	1,05	0	0	0	0	3	0,46
255-259,9	5	0,71	2	0,52	1	0,09	0	0	0	0
260-264,9	2	0,28	3	0,79	0	0	0	0	0	0
265-269,9	0	0	1	0,26	0	0	0	0	1	0,15
270-274,9	2	0,28	1	0,26	0	0	0	0	3	0,46
275-279,9	1	1,14	0	0	0	0	0	0	1	0,15
280-284,9	0	0	0	0	1	0,09	1	0,27	3	0,46
285-289,9	0	0	1	0,26	1	0,09	1	0,27	3	0,46
290-294,9	0	0	0	0	1	0,09	1	0,27	1	0,15
295-299,9	0	0	0	0	0	0	0	0	0	0
300-304,9	0	0	0	0	0	0	0	0	0	0
305-309,9	0	0	0	0	0	0	1	0,27	0	0
total no.	705		381		1097		377		648	

Table II- Length frequency of bluefin tuna fished by all different gears (except purse-seine) used by the Italian fleet in the southern Tyrrhenian Sea in the period 1985-1989. The table shows only catches over the Italian legal size (70 cm FL).

AREA: Southern Tyrrhenian Sea (Mediterranean)
Species: BLUEFIN TUNA (*Thunnus thynnus*) BFL
only catches over the Italian legal size (70 cm)
Gear: all gears UNCL (except PS)

LENGTH CLASSES	1985		1986		1987		1988		1989	
	no.	%	no.	%	no.	%	no.	%	no.	%
70-74,9	43	18,53	2	0,99	26	16,95	0	0	0	0
75-79,9	22	9,48	4	1,97	5	3,07	0	0	4	2,94
80-84,9	4	1,72	7	3,45	7	4,29	3	3,97	2	0,97
85-89,9	5	2,16	2	0,99	5	3,07	0	0	7	3,40
90-94,9	1	0,43	4	1,97	3	1,84	1	0,99	0	0
95-99,9	2	0,86	2	0,99	2	1,23	0	0	3	1,46
100-104,9	3	1,29	6	2,96	4	2,45	4	3,96	3	1,46
105-109,9	0	0	4	1,97	1	0,61	1	0,99	3	1,46
110-114,9	1	0,43	6	2,96	3	1,84	6	5,94	0	0
115-119,9	0	0	8	3,94	2	1,23	2	1,98	3	1,46
120-124,9	1	0,43	8	3,94	9	5,52	3	3,97	5	2,43
125-129,9	3	1,29	6	2,96	3	1,84	3	3,97	1	0,49
130-134,9	0	0	3	1,48	4	2,45	2	1,98	0	0
135-139,9	1	0,43	0	0	4	2,45	4	3,96	10	4,85
140-144,9	1	0,43	3	1,48	13	7,96	2	1,98	4	2,94
145-149,9	5	2,16	5	2,46	3	1,84	0	0	1	0,49
150-154,9	3	1,29	2	0,99	3	1,84	6	5,94	4	2,94
155-159,9	5	2,16	1	0,49	4	2,45	1	0,99	5	2,43
160-164,9	2	0,86	4	1,97	6	3,68	7	6,93	8	3,88
165-169,9	3	1,29	1	0,49	12	7,36	10	9,90	13	6,31
170-174,9	2	0,86	2	0,99	15	9,20	16	15,84	13	6,31
175-179,9	5	2,16	3	1,48	7	4,29	3	3,97	4	2,94
180-184,9	6	2,59	2	0,99	3	1,84	1	0,99	2	0,97
185-189,9	2	0,86	2	0,99	2	1,23	0	0	3	1,46
190-194,9	5	2,16	9	4,43	0	0	0	0	0	0
195-199,9	6	2,59	3	1,48	1	0,61	0	0	1	0,49
200-204,9	4	1,72	5	2,46	2	1,23	0	0	1	0,49
205-209,9	7	3,02	7	3,45	1	0,61	2	1,98	11	5,34
210-214,9	13	5,60	4	1,97	2	1,23	2	1,98	4	2,94
215-219,9	10	4,31	7	3,45	1	0,61	0	0	7	3,40
220-224,9	14	6,04	10	4,93	1	0,61	6	5,94	15	7,28
225-229,9	7	3,02	10	4,93	3	1,84	8	7,92	20	9,71
230-234,9	8	3,45	12	5,91	1	0,61	1	0,99	14	6,80
235-239,9	6	2,59	10	4,93	0	0	2	1,98	16	7,77
240-244,9	11	4,74	18	8,87	1	0,61	0	0	3	1,46
245-249,9	9	3,88	9	4,43	0	0	1	0,99	1	0,49
250-254,9	2	0,86	4	1,97	0	0	0	0	3	1,46
255-259,9	5	2,16	2	0,99	1	0,61	0	0	0	0
260-264,9	2	0,86	3	1,48	0	0	0	0	0	0
265-269,9	0	0	1	0,49	0	0	0	0	1	0,49
270-274,9	2	0,86	1	0,49	0	0	0	0	3	1,46
275-279,9	1	0,43	0	0	0	0	0	0	1	0,49
280-284,9	0	0	0	0	1	0,61	1	0,99	3	1,46
285-289,9	0	0	1	0,49	1	0,61	1	0,99	3	1,46
290-294,9	0	0	0	0	1	0,61	1	0,99	1	0,49
295-299,9	0	0	0	0	0	0	0	0	0	0
300-304,9	0	0	0	0	0	0	0	0	0	0
305-309,9	0	0	0	0	0	0	1	0,99	0	0
total no.	232		203		163		101		206	

Table III - Length frequency of albacore fished by all different gears (except purse-seine) used by the Italian fleet in the southern Tyrrhenian Sea in the period 1985-1989.

AREA: Southern Tyrrhenian Sea (Mediterranean)
Species: ALBACORE (Thunnus alalunga) ALB
Gear: all gears UNCL (except PS)

LENGTH CLASSES	1985		1986		1987		1988		1989	
	no.	%	no.	%	no.	%	no.	%	no.	%
30-34,9	0	0	0	0	0	0	0	0	0	0
35-39,9	1	0,16	0	0	1	0,17	0	0	1	0,20
40-44,9	1	0,16	0	0	2	0,34	3	1,51	0	0
45-49,9	0	0	1	0,16	1	0,17	1	0,17	3	0,59
50-54,9	2	0,31	9	1,42	5	0,86	4	6,79	3	0,59
55-59,9	25	3,88	48	7,58	14	2,41	27	4,58	18	3,54
60-64,9	75	11,65	24	3,79	47	8,08	63	10,70	51	10,04
65-69,9	132	20,50	80	12,64	91	15,64	111	18,85	114	22,44
70-74,9	125	19,41	166	26,22	129	22,17	107	18,17	103	20,28
75-79,9	75	11,65	115	18,17	121	20,79	84	14,26	71	13,98
80-84,9	86	13,35	79	12,48	71	12,20	86	14,60	68	13,39
85-89,9	73	11,34	80	12,64	72	12,37	65	11,04	45	8,86
90-94,9	41	6,37	25	3,95	22	3,78	31	5,26	26	5,12
95-99,9	5	0,78	4	0,63	5	0,86	5	0,85	3	0,59
100-104,9	0	0	1	0,16	1	0,17	2	0,34	1	0,20
105-109,9	1	0,16	0	0	0	0	0	0	0	0
110-114,9	1	0,16	1	0,16	0	0	0	0	1	0,20
115-119,9	0	0	0	0	0	0	0	0	0	0
120-124,9	1	0,16	0	0	0	0	0	0	0	0
125-129,9	0	0	0	0	0	0	0	0	0	0
130-134,9	0	0	0	0	0	0	0	0	0	0
135-139,9	0	0	0	0	0	0	0	0	0	0
140-144,9	0	0	0	0	0	0	0	0	0	0
145-149,9	0	0	0	0	0	0	0	0	0	0
150-154,9	0	0	0	0	0	0	0	0	0	0
total no.	644		633		582		589		508	

SWORDFISH (*XIPHIAS GLADIUS* L.) FISHERY IN THE SOUTHERN TYRRHENIAN SEA: A BRIEF REPORT (1985-1989)

by

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Key words: swordfish, Tyrrhenian Sea, gears, length classes.

ABSTRACT

This brief report on the swordfish fishery in the southern Tyrrhenian Sea gives preliminary information on the fishing technology used in this area and the fishery season.

CPUE data are available two years and a length-frequency analysis has been carried out using data for the last five years. The length-frequency distribution vary from year to year but the peak seems stable around 115 cm in the years 1987-1989.

THE SWORDFISH FISHERY

The swordfish fishery is traditional in the southern Tyrrhenian Sea. The harpoon fishery was first reported in the Strait of Messina in the tenth century B.C. (SISCI, 1984) and a drift-net fishery is known in the same area since 177 B.C. (Oppiano in SISCI, 1984), but the most ancient information about a swordfish fishery in Messina was first reported in the seventeenth century B.C. (Segre in SISCI, 1984).

The harpoon fishery is still carried on by a few special boats called "feluche" or "passerelle", with a very long steel front deck (max 55 m) and a high iron main topmast (max 33 m), with a small steering compartment at the top (SISCI *et al.*, 1988; SISCI & GOVERNALI, 1989). In 1989, only 18 "passerelle" were still in use, all in the area of the Strait of Messina.

Harpoon CPUE data are available only for two years (DI NATALE *et al.*, 1987) (parameters: C = swordfish catches in kg; E = average fishing days):

CPUE 1985 = 34,86

CPUE 1986 = 21,09

The drift-net fishery changed a lot after the second World War, when the boats were equipped with engines. The original vegetable-fibre nets were gradually substituted with multifilament nylon nets, and the length rapidly changed from 800 m to more than 10 km (depth is between 25 and 30 m), depending on the size of the fishing vessel. In recent years, nets of more than 30 km have been reported (DI NATALE *et al.*, 1990), even though this fishery could be still considered artisanal. The mesh size for the drift-nets, called "spadare", is from 32 cm to 48 cm, with a maximum frequency around 42 cm. Such gear can be used from April to September.

Another type of drift-net is called "palamitara" (mesh size between 18 and 32 cm), used for catching swordfish and albacore, in spring and autumn.

The drift-net fleet that operates in the southern Tyrrhenian Sea is quite a big one, with 497 boats in 1986 (estimated at over 650 in 1989), and other vessels may come from other areas in summer. More than 43% of the above-mentioned fleet use the drift-nets alternatively with other gears.

Drift-net CPUE data are available for 1985 and 1986 (DI NATALE *et al.*, 1987) (parameters: C = swordfish catches in kg; E = (net length/100 m) x number of days fished).

CPUE 1985 = 1,04

CPUE 1986 = 0,90.

Another gear commonly used for the swordfish fishery in the southern Tyrrhenian Sea is the surface drifting long-line: one type of gear has the adult swordfish as the target species (hook no. 0 to 2), but a second type of long line (hook no. 6 to 7 or 15 to 17), mostly used for the albacore, could have juvenile swordfish as the target.

The fleet using the surface drifting long-line is bigger than the one using drift-nets, with 717 boats in 1986 (DI NATALE *et al.*, 1987), but the boats are often very small and all the fleet should be considered as an artisanal one. In the last two years, an undefined percentage of the fleet left the long-line for the drift-net fishery, because of

the higher income and the cost of the bait (which could mean an independence from the wholesaler, too).

More than 58% of the boats use the drifting long line alternatively with other gears, depending on the season: the drifting long-line may be used all round the year, but juvenile swordfish fishery is still carried out mostly in autumn and winter from a certain number of villages.

Surface drifting long-line CPUE data are available for both types of gears, for 1985 and 1986 (DI NATALE et al., 1987) (parameters: C = swordfish catches in kg; E = (number of hooks/ 100) x fishing days; ASWLL = surface drifting long-line with big hooks; JSWLL = surface drifting long-line with small hooks):

CPUE 1985 = ASWLL 10,42; JSWLL 0,72

CPUE 1986 = ASWLL 5,65; JSWLL 0,01.

CPUE data for 1986 have been strongly influenced by bad weather in the area and by the sampling system (based on fixed days); JSWLL CPUE data are also affected by a more strict police control of illegal fishery.

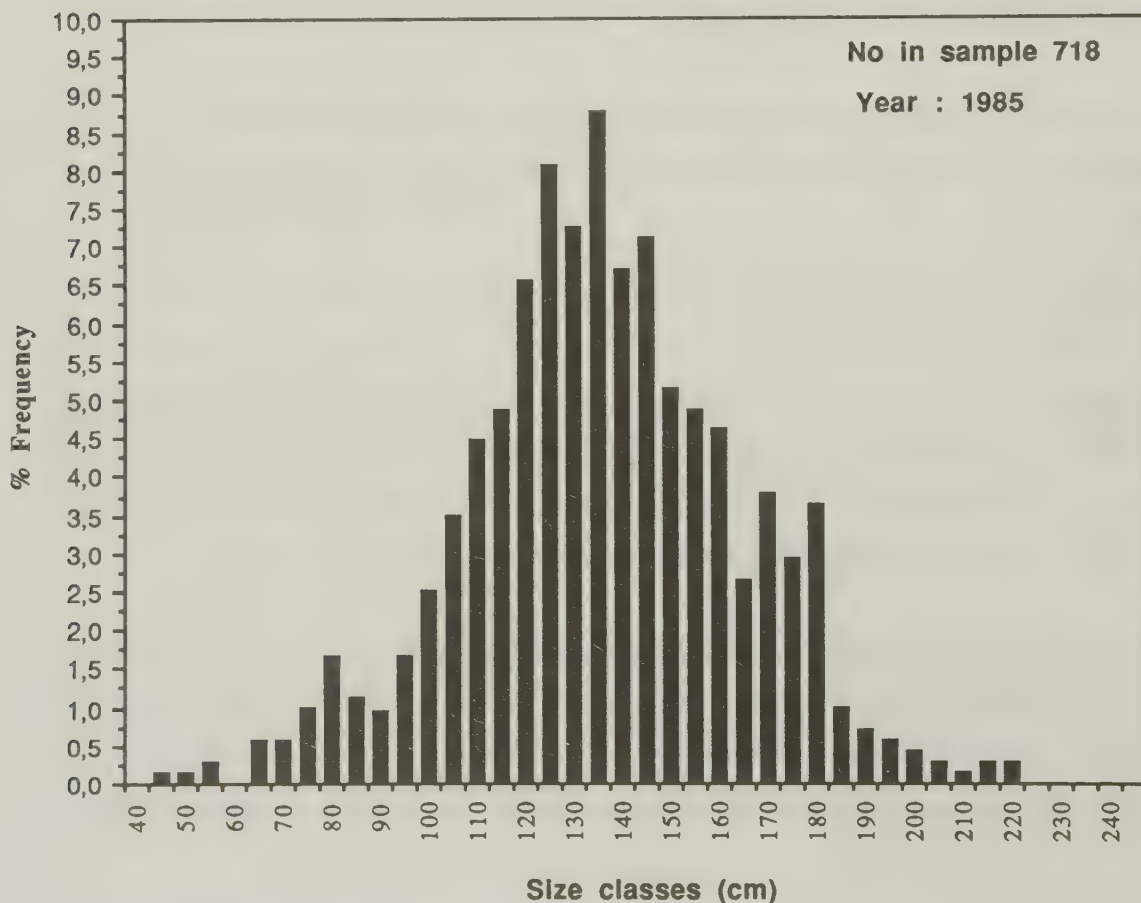


Fig. 1 - Length frequency distribution of swordfish in the southern Tyrrhenian Sea

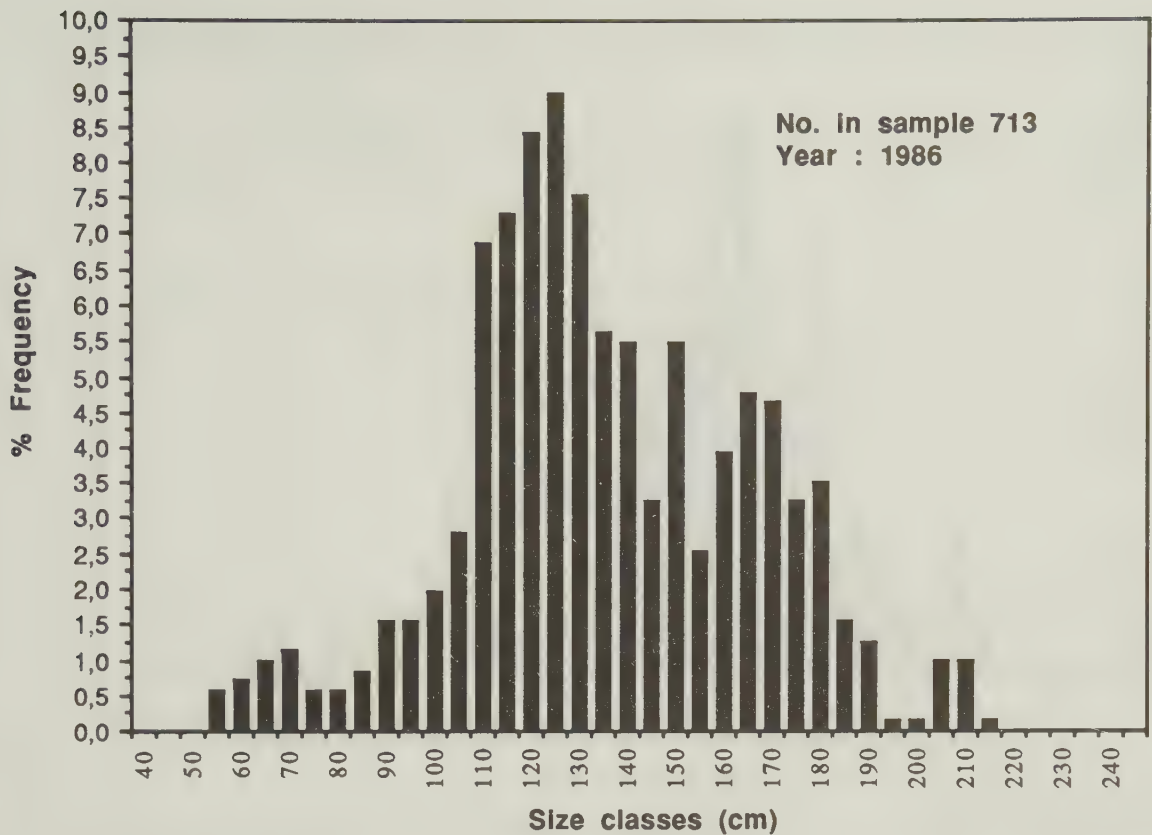


Fig. 2 - Length frequency distribution of swordfish in the southern Tyrrhenian Sea

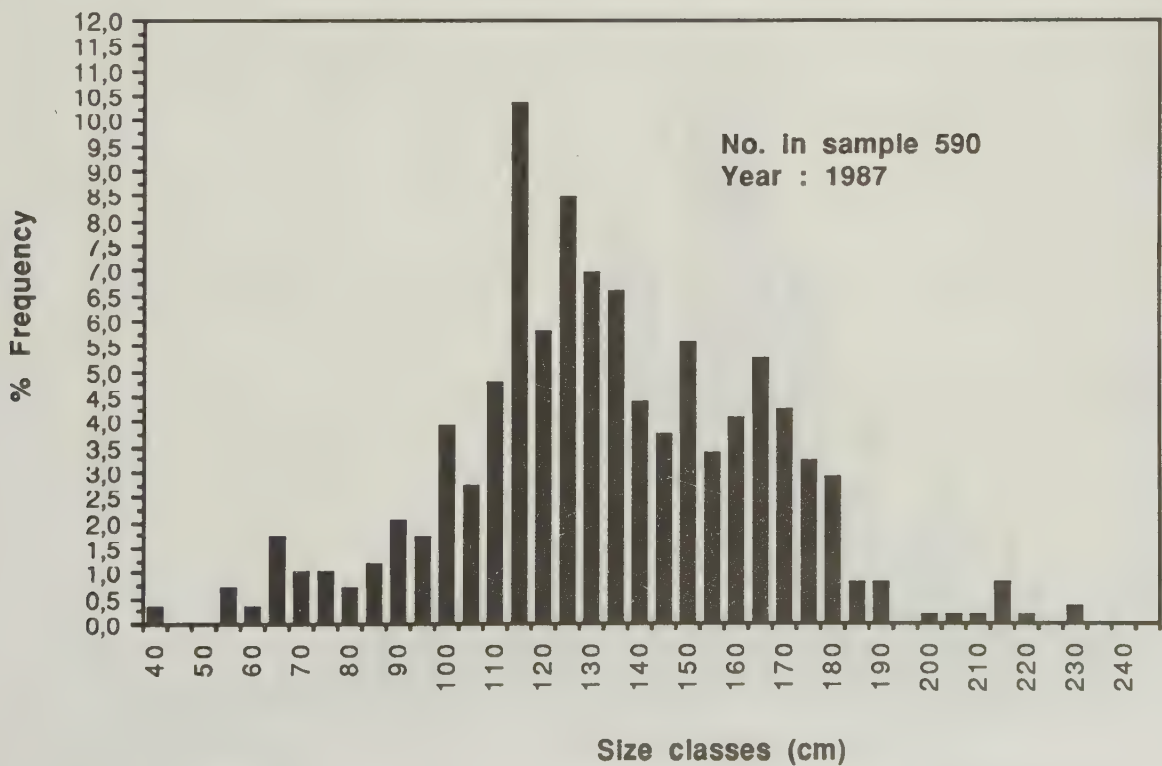


Fig. 3 - Length frequency distribution of swordfish in the southern Tyrrhenian Sea

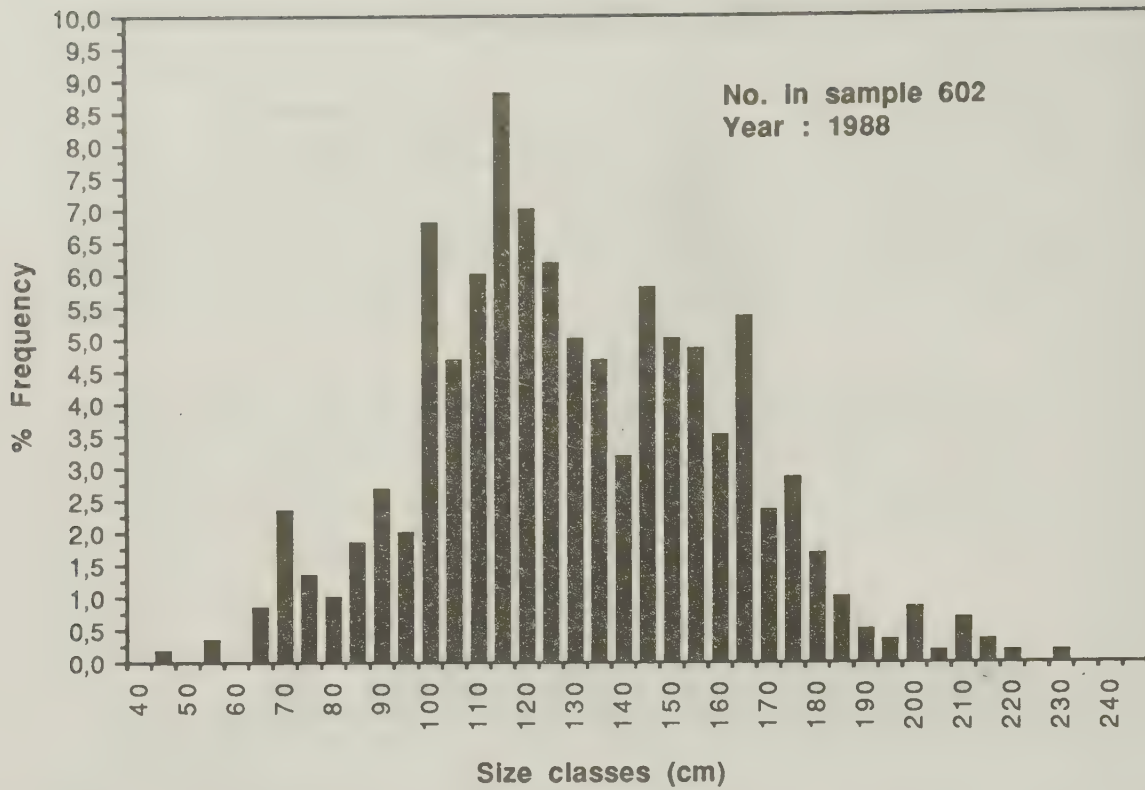


Fig. 4 - Length frequency distribution of swordfish in the southern Tyrrhenian Sea

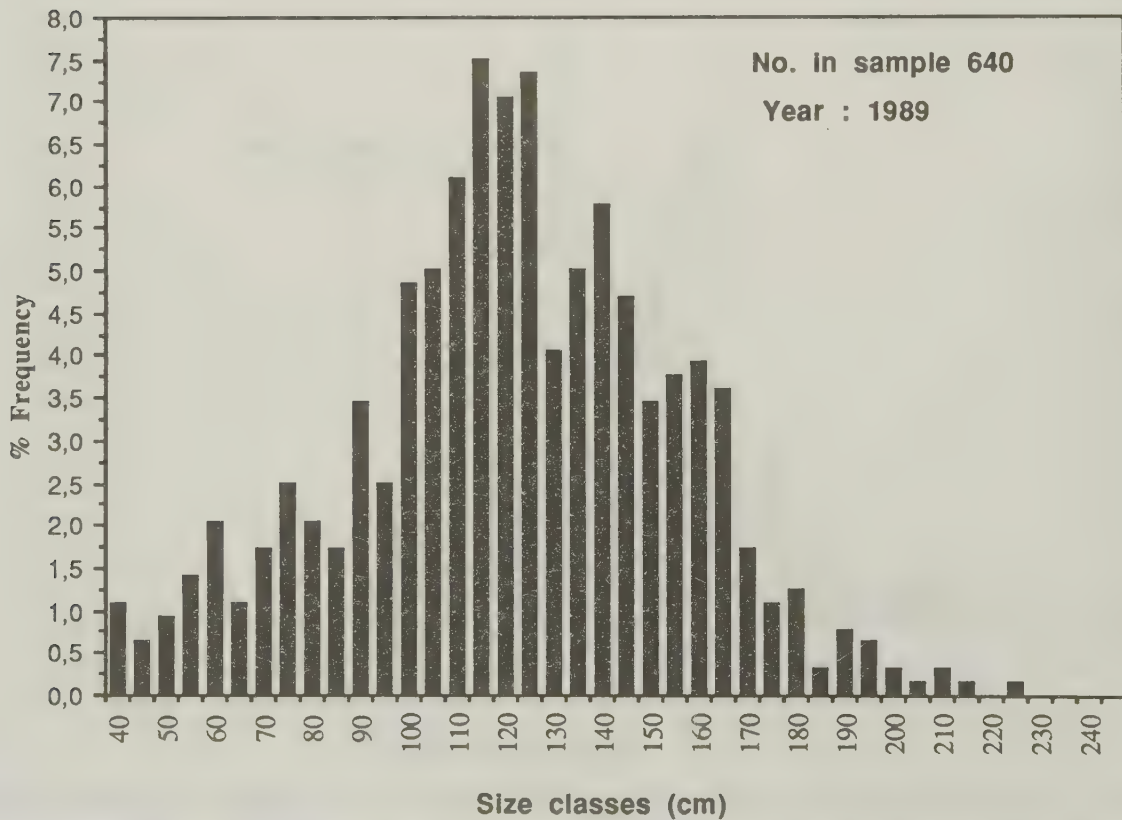


Fig. 5 - Length frequency distribution of swordfish in the southern Tyrrhenian Sea

LENGTH FREQUENCY

Continuous samplings of swordfish catches has been carried out at several points in southern Tyrrhenian Sea, in order to allow a length-frequency analysis of the stock.

In 1985 and 1986, sampling was carried out in the harbours of Lipari, S.Agata Militello, Milazzo, Vibo Marina, Bagnara Calabria, Messina and Ganzirri, under a grant from the Italian Ministry of Merchant Marine (law no. 41/82); in 1987, 1988 and 1989 sampling was done only in Messina, Milazzo and Ganzirri by Aquastudio, using private funding.

Length frequency (LJFL) distribution are shown in Figures 1 to 5, for the catches obtained by all the gears and without any separation by sex. Peaks occurred at 135 cm in 1985, 125 cm in 1986, 115 cm in 1987, 1988 and 1989, and the shapes of the distribution has not varied much in the last five years.

Another, smaller peak should exists below 60 cm LJFL, but it is almost impossible to collect data for small specimens at the landing points, because fishing them is illegal.

Weighted mean lengths are as follows:

year	1985	1986	1987	1988	1989
cm	136,1	137,3	125,4	122,9	123,8

CONCLUSIONS

The swordfish fishery has a great socio-economic importance for the people living around the southern Tyrrhenian Sea (and for the Italian fishery) and appears to be growing.

CPUE data (whether scientific or informal), length frequency data and mean length trends show a confused pattern, possibly linked to early reports of a general decrease in catches during the 1990 spring fishing season, even if the value of such index is relatively low.

Furthermore, the impact of the drift-nets causes a serious management problem for this fishery, in the southern Tyrrhenian Sea and in other Mediterranean basins.

A general reduction of the fishing effort seems to be necessary for the maintenance of the stock, but the application of any rules is extremely difficult, because of the migratory habit of the fleet and the wide distribution of the boats (spread all along the coasts). Furthermore, the very low number of wholesale fish markets makes it difficult to control the catches, mainly because of the fishery for juvenile specimens, which seems to be increasing all around the Mediterranean basin.

International agreement on a more strict control of the fishing effort on the swordfish stock in the Mediterranean is now an essential first step towards the management of this important resource.

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Table I - Length frequency of swordfish fished by all different gears (except purse-seine) used by the Italian fleet in the southern Tyrrhenian Sea in the period 1985-1989.

AREA: Southern Tyrrhenian Sea (Mediterranean)
Species: SWORDFISH (*Xiphias gladius*) SWO
Gear: all gears UNCL (except PS)

LENGTH CLASSES	1985		1986		1987		1988		1989	
	no.	%	no.	%	no.	%	no.	%	no.	%
40-44,9	0	0	0	0	2	0,34	0	0	7	1,09
45-49,9	1	0,14	0	0	0	0	1	0,17	4	0,63
50-54,9	1	0,14	0	0	0	0	0	0	6	0,94
55-59,9	2	0,29	4	0,56	4	0,68	2	0,33	9	1,40
60-64,9	0	0	5	0,70	2	0,34	0	0	13	2,03
65-69,9	4	0,56	7	0,98	10	1,69	5	0,83	7	1,09
70-74,9	4	0,56	8	1,12	6	1,02	14	2,32	11	1,72
75-79,9	7	0,97	5	0,56	6	1,02	8	1,33	16	2,50
80-84,9	12	1,67	5	0,56	4	0,68	6	1,00	13	2,03
85-89,9	8	1,11	6	0,84	7	1,19	11	1,83	11	1,72
90-94,9	14	0,95	11	1,54	12	2,03	16	2,66	22	3,44
95-99,9	1	1,67	11	1,54	10	1,69	12	1,99	16	2,50
100-104,9	18	2,51	14	1,96	23	3,90	41	6,81	31	4,84
105-109,9	25	3,48	20	2,81	16	2,71	28	4,65	32	5,00
110-114,9	32	4,46	49	6,87	28	4,75	36	5,98	39	6,09
115-119,9	35	4,87	52	7,29	61	10,34	53	8,80	48	7,50
120-124,9	47	6,55	60	8,42	34	5,76	42	6,98	45	7,03
125-129,9	58	8,08	64	8,98	50	8,47	37	6,15	47	7,34
130-134,9	52	7,24	53	7,53	41	6,95	30	4,98	26	4,06
135-139,9	63	8,77	40	5,61	39	6,61	28	4,65	32	5,00
140-144,9	48	6,69	39	5,47	26	4,41	19	3,16	37	5,78
145-149,9	51	7,10	23	3,23	22	3,73	35	5,81	30	4,69
150-154,9	37	5,15	39	5,47	33	5,59	30	4,98	22	3,44
155-159,9	35	4,87	18	2,52	20	3,39	29	4,82	24	3,75
160-164,9	33	4,60	28	3,93	24	4,07	21	3,49	25	3,91
165-169,9	19	2,65	34	4,77	31	5,25	32	5,32	23	3,59
170-174,9	27	3,76	33	4,63	25	4,24	14	2,32	11	1,72
175-179,9	21	2,92	23	3,23	19	3,22	17	2,82	7	1,09
180-184,9	26	3,62	25	3,51	17	2,88	10	1,66	8	1,25
185-189,9	7	0,97	11	1,54	4	0,78	6	1,00	2	0,31
190-194,9	5	0,70	9	1,26	4	0,78	3	0,50	5	0,78
195-199,9	4	0,56	1	0,14	0	0	2	0,33	4	0,63
200-204,9	3	0,42	1	0,14	1	0,17	5	0,83	2	0,31
205-209,9	2	0,28	7	0,98	1	0,17	1	0,17	1	0,16
210-214,9	1	0,14	7	0,98	1	0,17	4	0,66	2	0,31
215-219,9	2	0,28	1	0,14	4	0,78	2	0,33	1	0,16
220-224,9	2	0,28	0	0	1	0,17	1	0,17	0	0
225-229,9	0	0	0	0	0	0	0	0	1	0,16
230-234,9	0	0	0	0	2	0,34	1	0,17	0	0
235-239,9	0	0	0	0	0	0	0	0	0	0
240-244,9	0	0	0	0	0	0	0	0	0	0
245-249,9	0	0	0	0	0	0	0	0	0	0
total no.	718		713		590		602		640	

Table II - Length frequency of swordfish fished by all different gears (except purse-seine) used by the Italian fleet in the southern Tyrrhenian Sea in the period 1985-1989. The table shows only catches over the Italian legal size (140 cm UJFL, = about 100 cm LJFL).

AREA: Southern Tyrrhenian Sea (Mediterranean)

Species: SWORDFISH (*Xiphias gladius*) SWO

only catches over the Italian legal size (140 cm UJFL = about 100 cm LJFL)

Gear: all gears UNCL (except PS)

LENGTH CLASSES	1985		1986		1987		1988		1989	
	no.	%	no.	%	no.	%	no.	%	no.	%
100-104,9	18	2,76	14	2,15	23	5,36	41	8,78	31	6,14
105-109,9	25	3,83	20	3,07	16	3,04	28	5,31	32	6,34
110-114,9	32	4,90	49	7,53	28	5,31	36	6,83	39	7,72
115-119,9	35	5,36	52	7,99	61	11,58	53	10,06	48	9,51
120-124,9	47	7,20	60	9,22	34	6,45	42	7,97	45	8,91
125-129,9	58	8,88	64	9,83	50	9,49	37	7,02	47	9,31
130-134,9	52	7,96	53	8,14	41	7,78	30	5,69	26	5,15
135-139,9	63	9,65	40	6,14	39	7,40	28	5,31	32	6,34
140-144,9	48	7,35	39	5,99	26	4,93	19	3,61	37	7,33
145-149,9	51	7,81	23	3,53	22	4,17	35	6,64	30	5,94
150-154,9	37	5,67	39	5,99	33	6,26	30	5,69	22	4,36
155-159,9	35	5,36	18	2,77	20	3,80	29	5,50	24	4,75
160-164,9	33	5,05	28	4,30	24	4,55	21	3,99	25	4,95
165-169,9	19	2,91	34	5,22	31	5,88	32	6,07	23	4,55
170-174,9	27	4,14	33	5,07	25	4,74	14	2,66	11	2,18
175-179,9	21	3,22	23	3,53	19	3,61	17	3,23	7	1,39
180-184,9	26	3,98	25	3,84	17	3,23	10	1,90	8	1,58
185-189,9	7	1,07	11	1,69	4	0,76	6	1,14	2	0,40
190-194,9	5	0,77	9	1,38	4	0,76	3	0,57	5	1,00
195-199,9	4	0,61	1	0,15	0	0	2	0,38	4	0,79
200-204,9	3	0,46	1	0,15	1	0,19	5	0,95	2	0,40
205-209,9	2	0,31	7	1,08	1	0,19	1	0,19	1	0,20
210-214,9	1	0,15	7	1,08	1	0,19	4	0,76	2	0,40
215-219,9	2	0,31	1	0,15	4	0,76	2	0,38	1	0,20
220-224,9	2	0,31	0	0	1	0,19	1	0,19	0	0
225-229,9	0	0	0	0	0	0	0	0	1	0,20
230-234,9	0	0	0	0	2	0,38	1	0,19	0	0
235-239,9	0	0	0	0	0	0	0	0	0	0
240-244,9	0	0	0	0	0	0	0	0	0	0
245-249,9	0	0	0	0	0	0	0	0	0	0
total no.	653		651		527		527		505	

INTERACTION BETWEEN MARINE MAMMALS AND SCOMBRIDAE FISHERY ACTIVITIES: THE MEDITERRANEAN CASE.

by

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Key words: marine Mammals, Scombridae fishery, Mediterranean Sea, gears.

ABSTRACT

This brief report gives a general information on interaction between marine mammals and Scombridae fishery activities in the Mediterranean Sea, where a rapid increase of cases has been reported in the last ten years.

An increase of the fishing effort in swordfish fishery seems to be the cause of several entanglements, due to the increase in using very long drift-nets in off-shore fishery.

Intentional catches, sonar interferences and predation on fishing gears are also briefly reviewed in this report.

INTRODUCTION

Whaling in the Mediterranean Sea has been reported in a few places, such as the area of the Strait of Gibraltar, where whaling stations operated till about 1950 (BOLOGNARI, 1951), and in the Ligurian Sea, where a tradition is still carried on: a certain number of cetaceans (*Stenella coeruleoalba*, *Tursiops truncatus* and, sometimes, *Delphinus delphis*, *Grampus griseus* or *Globicephala melæna*) are taken each year to make dried meat fillets, called "musciame", in spite of a total conservation law adopted by the Italian Government in 1980 (CATTANEO VIETTI *et al.*, 1988).

Some hundreds of small dolphins (*Stenella coeruleoalba* and *Delphinus delphis*) are also reported to be caught by tuna-trolling fisheries in French waters (COLLET, 1983) but since these animals are also intentionally killed by French fishermen for food or

to scare them away from the tuna-trolling lines (DUGUY and HUSSENOT, 1982), it is difficult to make a clear separation between intentional and incidental catches by lines (SCIALABBA, in press).

Some intentional killings by explosives or, more commonly, by rifles, are also reported occasionally (DUGUY *et al.*, 1983) in Italian and French waters.

A certain number of large whales (*Balaenoptera physalus* and *Physeter macrocephalus*) incidentally die as a result of collision with boats and a few specimens of various cetaceans (*Stenella coeruleoalba*, *Delphinus delphis*, *Tursiops truncatus*, *Grampus griseus*, *Ziphius cavirostris* and *Physeter macrocephalus*) are occasionally killed by harpoons, mostly in the vicinity of the Strait of Messina.

Monk seals (*Monachus monachus*) have been intentionally killed by fishermen many times in the past, and a specimen was harpooned by a scuba-diver less than twenty years ago, in the water around the Isle of Marettimo (Aegadi Isles, W. Sicily).

However, only a small number of marine mammals are reported to be killed intentionally in the Mediterranean Sea each year.

Nevertheless, the problem here as in other seas of the world, is the very large number of incidental catches in fishery activities; this is a problem that has emerged in the last ten years.

INCIDENTAL CATCHES IN FISHING GEAR

Fishing is one of the most typical traditional activities in the Mediterranean and the variety of fishing gear is incredible: a very high number of fishermen and thousands of boats and vessels, using almost all the types of fishing gear known in the world, making the Mediterranean an intensive fishing area.

The impact of a so high a number of boats and gears on marine mammals is strictly correlated with the density of boats and with the selectivity of the gears.

Some catches are very difficult to explain and they are accidental. On the hand, how can the capture of a young fin whale in a drifting long-line near Syracuse (E. Sicily) (DI NATALE & MANGANO, 1983a), or the entanglement of a female sperm

whale in a coastal trammel gillnet near Torrenova (N. Sicily) (DI NATALE & MANGANO, 1983b) be explained?

Each gear probably has its own "preferential" species, with respect to the possibility of interference with marine mammals.

LINES

An undetermined number of striped and common dolphins are incidentally caught by tuna-trolling boats in French waters every year (COLLET, 1983).

LONG LINES

Surface drifting long-lines are commonly used all around the Mediterranean for catching tuna, albacore, swordfish and tuna-like fishes, but only a few cases of incidental catches of marine mammals are reported, probably because of the high sonar reflectivity of the hooks, which should be easily detected by Odontocetes, which are reported to have been taken by long-lines occasionally.

Furthermore, reports of incidental catches by long-lines are very difficult to collect, because the cetaceans are often released alive at sea by the fishermen.

Two striped dolphins (*Stenella coeruleoalba*) have been reported to have been taken by long line in Italy and Spain; two Risso's dolphins (*Grampus griseus*) were caught near Acitrezza (E.Sicily) (DI NATALE , 1983) and in the Gulf of Taranto (ROSITANI, pers. comm.); a rare couple of false killer whales (*Pseudorca crassidens*) were caught and killed off the Calabrian Tyrrhenian coast (DI NATALE & MANGANO, 1983c) and a young fin whale (*Balaenoptera physalus*) was unusually caught off Syracuse (E. Sicily) (DI NATALE & MANGANO, 1983b). A bottlenose dolphin (*Tursiops truncatus*) has been reported killed by a long-line in the southern Adriatic Sea (ROSITANI, pers. comm) and another one has been recently caught off Genova (Ligurian Sea), in autumn 1989.

In all these cases, the gear was a surface drifting long-line, equipped for swordfish fishing.

Incidental catches of monk seals (*Monachus monachus*) by long-lines (unclassified) have been observed in Greek waters (NORTHRIDGE, 1984).

SURFACE DRIFTING GILLNETS

This type of gear has been greatly increased in number in the last 15 years, especially in the Italian fleet. During the swordfish fishing season, which is from April to September (occasionally, in the past, from March to October, depending by favourable weather conditions) a very high density of nets set by about 900 Italian boats, creates a nearly continuous barrier (the average length of a single net is about 12 km) in the upper layer of the sea, with a higher density in the southern Tyrrhenian Sea; consequently, cetacean entanglements happen very frequently.

Several species have been reported entangled in drift-nets during the last 15 years (*Stenella coeruleoalba*, *Tursiops truncatus*, *Grampus griseus*, *Globicephala melaena*, *Ziphius cavirostris*, *Physeter macrocephalus*, *Balaenoptera acutorostrata* and *Balaenoptera physalus*) in the Mediterranean (DUGUY *et al.*, 1983; DI NATALE, in press; SCIALABBA, in press, NOTARBARTOLO DI SCIARA, in press), but only in the last four years has it been possible to obtain improved statistics for the Italian seas, after the creation of the "Centro Studi Cetacei", a special organization of the Italian Society for Natural Science.

The latest statistics, covering the period between 1986 and 1988, show a list of 2 fin whales, 24 sperm whales, 2 Cuvier's beaked whales, 10 pilot whales, 5 Risso's dolphins, 13 bottlenose dolphins, 58 striped dolphins and 27 unidentified cetaceans (DI NATALE, 1990), but a very large amount of small Delphinidae (personally estimated from 3,000 to 5,000 per year) are not officially reported.

Nine sperm whales and four pilot whales, entangled in drift-nets, were successfully rescued and released at sea in the last three years.

A high number of entanglements in the Ligurian Sea appears to be strictly correlated with a very rapid increase in the surface drift-net fishing effort in this area (PODESTA' & MAGNAGHI, in press).

The increasing number of reported entanglements in drift-nets is probably due to a combination of factors: the effect of a rapid increase in the fishing effort, the density and distribution of the boats in certain areas and the results of more accurate observation.

It is now generally believed that Mediterranean drift-nets are the most important factor in the mortality of the sperm whale population in this area.

No recent reports from other Mediterranean countries are known, but this is probably due to the absence of local drift-net fleets or to the absence of a local survey programme.

OTHER GEARS

A killer whale was incidentally captured in a tuna trap on the northern coast of Sicily (DI NATALE & MANGANO, 1983c).

Interference between Delphinidae and purse-seiners fishing for small pelagic fishes have been rarely reported, but tuna purse-seiners are known to capture striped dolphins, pilot whales and other Delphinidae with a higher frequency, (DUGUY *et al.*, 1983; DI NATALE & MANGANO, 1982; MAGNAGHI & PODESTA', 1987), even if the total amount of the captures per year is very low.

SONAR INTERFERENCE

No data on sonar interference with cetacean communication systems have been reported in the Mediterranean, but no research has been carried out on this subject.

It is expected to interfere with social communication in cetaceans, particularly in the area in which there is a great density of trawl fishing, since sonars are more commonly used in such activity.

INTERFERENCE ON MIGRATION

No data on interference between fishing gears and the migration of some species of cetaceans exist in the Mediterranean.

A high density of surface drift-nets in some areas (e.g.: southern Tyrrhenian Sea) could cause changes in the migration courses of small schooling species (e.g.: *Stenella*

coeruleoalba) or large whales (e.g.: *Physeter macrocephalus*), but no research has been carried out on this subject.

No recent data exist on marine mammal migration courses in the Mediterranean Sea.

PREDATION ON FISHING GEARS

Marine mammal predation on fishing gear has been reported for years in journalistic articles but no scientific reports have been made in recent years; only historical records exist (SCORDIA, 1936), mostly concerning pilot whales observed feeding on tuna in the Strait of Messina.

Sperm whales have been frequently observed swimming under tuna schools in the southern Tyrrhenian Sea (SARA', 1984) but they are not known to feed on tuna, even if a sperm whale caught in Lipari (MOJO & CAVALLARO, 1972) had two atlantic bonitos (*Sarda sarda*) in the stomach content.

Striped dolphins (*Stenella coeruleoalba*) have been several times observed at night feeding on squids near signal-oil-lamps of drift-nets.

CONCLUSIONS

Marine mammal interference with fishing seems to be very frequent in the Mediterranean Sea, but nothing is known about the real situation in the southern and eastern Mediterranean, and only an undefined percentage of cases have been reported in other parts (SCIALABBA, in press).

As a consequence of this situation, incidental catches and entanglements are often underestimated. Also, dead marine mammals usually sink (except the sperm whale) and so only a minimum number is washed ashore.

Intervention by the Mediterranean governments is now necessary, to limit drift-net effort, to establish new common rules and to study new methods to avoid incidental catches, using different technology or modified fishing gear, to allow a certain level of fishing activity and catches, without depleting the cetacean stock.

A parallel effort must be pursued by the scientists and international organizations (e.g., FAO, UNEP, ICCAT and ICSEM), to make a first estimation of the Mediterranean population of cetaceans and to understand the real ratio of incidental catches per species.

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LES FILETS MAILLANTS DERIVANTS

Caractéristiques et développement

par

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Abstract

The introduction of synthetic fibre in the making of gillnets has expanded the use of the type of gear to the large pelagic fishing. This was also facilitated in the introduction of net in the fishing operations. These two factors which added to the relatively high price of large pelagic fish led to a substantial increase in the fishing effort by the use of larger fishing boats, and of longer driftnets.

These nets are of two types: the normal one and the driftnets. The latter have generally very large mesh (400 to 460 mm).

The colour of the nets, and their setting are important factors which determine their efficiency. Though more selective than most of the other fishing gear, driftnets catch four categories of organisms: target species, species of secondary commercial interest, by-catch species of low commercial value and protected species (sea mammals, turtles, etc.). Scientists express some concern not only about protected species entangled by the driftnets but also about target species that are overexploited (swordfish).

Driftnets may also cause difficulties to navigation and tourist activities. This explains why it is necessary to adopt restrictive regulations concerning the fishing seasons, grounds and effort and also the dimensions of the nets which should not extend five miles by day by boat.

1. INTRODUCTION

Les filets maillants dérivants figurent parmi les plus anciens et les plus utilisés à travers les siècles, surtout avant l'apparition des moteurs et de la pêche industrielle, qui s'est développée durant les dernières années;

Des filets maillants spéciaux existaient pour chaque type de poisson pélagique, depuis les sardinières, pour la pêche aux anchois et aux sardines, aux pélamidières, pour pêcher les bonites, à ceux destinés à la pêche spécifique des bogues, du germon, ou de l'espadon.

Le seul vrai problème que posaient ces filets, dans le passé, était celui de leur entretien car les opérations de pêche qui sont aujourd'hui mécanisées peuvent aussi être aisément effectuées à la main.

Les fibres naturelles dont ils étaient faits, qu'il s'agisse du chanvre ou du coton, imposaient que l'on fasse sécher entièrement les filets au bout de quelques jours de pêche, afin d'éviter leur putréfaction, et cette opération demandait à la fois du temps et de la fatigue. D'autre part, toujours dans le but de donner au filet une certaine résistance à la putréfaction et à l'action des microorganismes en général, il était utile de procéder fréquemment à des traitements spéciaux qui consistaient en général à faire bouillir les filets en y ajoutant certaines substances, grâce auxquelles ils pouvaient résister à la moisissure, ce qui leur donnait aussi, normalement, une couleur particulière.

Les caractéristiques des fibres synthétiques sont, d'une part, une très grande ténacité (d'où la possibilité d'utiliser des fils plus fins et d'en faire des filets pouvant mailler plus de poissons) et, d'autre part, une imputrescibilité telle qu'elle évite toute opération de séchage et d'entretien des filets. Ainsi, l'introduction de ces fibres dans le monde de la pêche a permis un développement rapide des filets maillants, surtout dans le cadre de la pêche aux grands poissons pélagiques car, en ce qui concerne les petits poissons pélagiques, la tendance a plutôt été de remplacer les filets maillants par des chaluts pélagiques, plus rentables, dont on peut dire qu'ils ont aujourd'hui totalement effacé la pêche à la sardinière et réduit considérablement celle au lamparo.

Outre l'introduction des fibres synthétiques, on a également assisté au développement de la mécanisation des opérations de récupération du filet, à travers l'utilisation du vire-filet grâce auquel les opérations de pêche s'avèrent plus rapides et surtout, moins fatigantes.

Ces deux innovations, ainsi que l'abondance des prises et la valeur élevée du poisson lui-même, ont permis d'assister à une augmentation du nombre et des dimensions des embarcations qui opèrent avec ces engins et surtout, à une augmentation de la longueur de filet que chaque embarcation utilise chaque jour.

La croissance de notre flotte de fileyeurs a été rapide, tumultueuse, peu contrôlée. C'est pourquoi il n'a pas encore été possible de réunir des informations sûres et précises sur sa consistance réelle. Les données des recherches datant d'il y a quelques années indiquaient environ 700 embarcations opérant, de façon saisonnière, avec des filets maillants dérivants, et environ 3.000 personnes employées à bord.

Des études plus récentes, bien qu'elles ne soient pas terminées, indiquent un nombre légèrement supérieur. Quoiqu'il en soit, l'on peut dire que l'Italie dispose d'une flotte consistante de fileyeurs pêchant les grands poissons pélagiques.

2. LES FILETS UTILISES ET LES TECHNIQUES DE PECHE.

2.1. Matières textiles pour la confection du filet.

La fibre textile utilisée pour la confection du filet maillant dérivant est la fibre polyamide (nylon). Le nylon possède en effet toutes les qualités adéquates pour la réalisation d'un excellent filet: ténacité élevée, poids spécifique peu supérieur à 1, flexibilité, souplesse et, enfin, une importante élasticité, ce qui rend encore plus improbable la rupture du filet.

Le fil est produit par torsion, à partir d'un multifilament. Des expériences ont été tentées avec un multimonofilament et, même si elles n'ont pas donné de résultats négatifs, ce type particulier de produit n'est pas beaucoup aimé des pêcheurs, car le filet que l'on obtient ainsi occupe, à longueur égale, un plus grand volume.

Le noeud (noeud simple) est effectué au moyen d'un chassis à faire les noeuds et il est ensuite fixé grâce à des traitements spéciaux de fixage.

La stabilité du noeud est considérée comme une caractéristique déterminante si l'on veut évaluer la qualité d'un filet destiné à armer un filet maillant dérivant.

On n'utilise pas, pour ce type de filet, d'autres fibres. Aucune autre fibre synthétique ne présente les caractéristiques idéales pour un filet dérivant.

La fibre de polyéthylène a un poids spécifique inférieur à 1 et, surtout, elle est trop dure: elle ne possède donc pas la capacité qu'a le nylon de former un piège parfait pour le poisson, grâce à son adhérence au poisson lui-même, due à sa flexibilité et à sa souplesse.

La fibre polyester est trop lourde et surtout, peu élastique. Elle est donc plus fragile que la fibre polyamide, même si elle peut produire un filet aussi souple et flexible.

La fibre de polypropylène, outre le fait qu'elle est la plus légère, donc "flottante", offre surtout une faible résistance aux rayons du soleil. Elle ne peut donc durer longtemps, étant donné que le filet se trouve fortement exposé à la lumière, aussi bien à bord que durant la pêche, puisqu'on l'utilise en surface.

2.2. Ralingues.

Les ralingues supérieure et inférieure sont généralement constituées d'un multifilament en polyamide tressé. Il s'agit le plus souvent de cordes tressées d'un diamètre réduit, d'autant plus réduit si l'on considère la dimension globale du filet.

En effet, les ralingues ne sont pas considérées comme des points de renforcement du filet, ni comme des structures sur lesquelles on peut éventuellement forcer, si nécessaire, lors du virage. Au contraire, on les considère uniquement comme des supports pour les flotteurs et le lest. Ainsi, il n'est pas indispensable que leur force de rupture soit élevée ni que leur diamètre soit consistant.

La ralingue inférieure est souvent formée d'une tresse, le lest étant à l'intérieur, de façon à ce que ce dernier ne puisse gêner les opérations de pêche et s'accrocher aux mailles du filet. Cette tresse lestée, bien qu'elle ait un diamètre extérieur apparemment élevé, possède forcément, de par sa technique constructive, une très faible force de rupture. On remédie à cet inconvénient au moment de l'armement du filet, en adoptant des rapports d'armement plus élevés.

2.3. Rapports d'armement.

Dans l'armement des filets maillants, le paramètre le plus important est le rapport d'armement. On considère en effet que la quantité de poisson que l'engin de pêche est en mesure de capturer est liée à ce paramètre.

Ainsi, plus on a de filet par rapport aux ralingues, plus il est probable que le poisson se prenne au piège de façon irréversible. Pour des raisons d'ordre pratique et pour faciliter les manoeuvres de filage et de virage de l'engin de pêche, il est en revanche opportun que le filet ne soit pas trop abondant, par rapport aux ralingues.

Face à ces deux exigences contradictoires, on finit normalement par choisir un juste milieu, de façon à ce que le filet garde une bonne capacité de maillage tout en étant encore maniable, surtout si l'on opère avec un vire-filet.

Ce choix amène généralement à établir des rapports d'armement allant de 60% à 70%.

Toutefois, ceci ne s'applique pas aux filets maillants dérivants utilisés en Italie pour les grands poissons pélagiques. On adopte alors des rapports d'armement très élevés, proches de 100% voire, dans certains cas, supérieurs à 100%.

Il semble donc que l'on privilégie la maniabilité, plutôt que les capacités de pêche de l'engin. A dire vrai, cette affirmation s'avère peu crédible, car le rapport d'armement n'est pas fixé par la loi, mais choisi par les pêcheurs eux-mêmes - et leur désir est de bien pêcher - et, d'autre part, des rapports d'armement d'environ 100% permettent eux aussi, dans la pêche professionnelle, des prises consistantes.

La chose s'explique de par l'étroitesse du diamètre des ralingues qui cessent ainsi de remplir le seul rôle de supports des flotteurs ou du lest. En effet, les ralingues ont un diamètre presque comparable à celui des fils qui composent le filet lui-même: ce dernier se trouve donc entièrement libre, presque comme si les ralingues n'existaient pas, et garde toute sa capacité de maillage.

D'ailleurs, durant la pêche, la ralingue ne reste certainement pas tendue, mais elle s'adapte à la forme que la maille du filet veut prendre. En revanche, pendant la phase de récupération, le filet et les ralingues, de longueurs pratiquement identiques, se tendent simultanément, contribuant chacun à ce que le tout résiste parfaitement à tout type de déchirure, aux conditions de la mer, ou même, à une éventuelle fausse manoeuvre.

Ainsi les opérations, lors du virage du filet, sont grandement simplifiées et le vire-filet peut travailler sans difficulté ni risque de rupture.

Enfin, une dernière considération sur l'armement de la ralingue inférieure, avec un rapport d'armement parfois supérieur à 100%, surtout dans le cas d'une ralingue lestée de l'intérieur:

Il est courant que le rapport d'armement de la ralingue inférieure dépasse celui de la ralingue supérieure, surtout dans certaines marines, mais ce rapport ne dépasse, parfois, 100% que dans le cas des filets maillants dérivants utilisés pour les grands poissons pélagiques.

Comme nous l'avons déjà spécifié dans le cas des ralingues lestées, formées d'une âme en plomb et d'une gaine externe en nylon tressé, la force de rupture de la ralingue est alors, sans aucun doute, très basse.

Donc, si l'utilisation de la ralingue lestée permet d'éviter que le lest, autrement situé à l'extérieur, ne s'accroche dans les mailles, ce même type de ralingue pose des problèmes à cause de sa faible force de rupture et il est nécessaire qu'elle ne se trouve jamais en tension.

Elle doit donc au moins être armée avec un rapport d'armement de 100%. D'autre part, étant donné que le nylon, lorsqu'il est mouillé, augmente de longueur d'environ 10%, suivant le type de traitement qu'il a suivi lors de la construction de la nappe de filet ou de la ralingue, il pourrait arriver, à cause d'un allongement inégal entre la ralingue et le filet, que la ralingue se mette en tension au moment du virage, même si l'on a un rapport d'armement de 100%.

C'est pour éviter cela que l'on a tendance à armer la ralingue inférieure, lorsqu'il s'agit d'une ralingue lestée, avec un rapport d'armement supérieur à 100%.

Le tableau n°1 montre les rapports d'armement des filets pour lesquels on a pu obtenir le plan de filet.

2.4. Dimensions des mailles utilisées.

Les mailles utilisées sont en général très grandes, ce qui est une caractéristique commune aux filets maillants dérivants en usage dans d'autres pays. Durant ces dernières années, on a enregistré une nouvelle augmentation des dimensions des mailles: en somme, les filets de construction récente, armés pour aller s'ajouter à ceux déjà utilisés à bord ou pour équiper de nouveaux bateaux, ont des mailles plus grandes que ceux qui étaient utilisés dans les années 70.

Selon des informations fournies par un producteur de nappes de filet, alors qu'au début des années 70 on construisait des filets avec des mailles jusqu'à 300 mm de longueur, on les construit aujourd'hui avec des mailles de 400 mm, pouvant même atteindre, dans le cadre d'une production normale, 460 mm. Naturellement, ceci vaut pour les filets à espadon. En ce qui concerne les filets à germon, on est passé de 160 à 200 mm de longueur.

Les filets dont on a pu prendre le plan de filet et dont les caractéristiques sont indiquées dans le tableau, avaient des mailles d'une longueur comprise entre 340 et 460 mm pour la pêche à l'espadon et, entre 160 et 180 mm pour la pêche au germon.

Cette augmentation de la dimension des mailles lors des dernières années a porté à une augmentation de la hauteur du filet, allant parfois jusqu'à 35 mètres.

La variation de ces deux caractéristiques, dimension de la maille et hauteur du filet, est considérée par certains comme une cause possible de la capture de mammifères marins.

2.5. Couleur du filet.

Selon l'avis des pêcheurs, la couleur du filet revêt une extrême importance. Il arrive qu'une série de filets soit refusée à la livraison parce qu'elle ne présente pas la teinte souhaitée par le pêcheur. Parfois, aussi, le pêcheur teint lui-même son filet, avec des moyens rudimentaires, n'arrivant pas toujours à trouver un producteur qui satisfasse ses exigences.

Etant donné que ce type de filet travaille en surface, dans des eaux généralement limpides, il est compréhensible que sa couleur ait une grande importance pour la bonne réussite de l'opération de pêche. Moins le filet est visible et repérable par le poisson, plus il permettra des prises abondantes.

Il n'est pas compréhensible, toutefois, qu'un pêcheur refuse une couleur d'une certaine tonalité, parce qu'elle ne peut donner lieu à une pêche fructueuse, alors qu'un autre, opérant dans les mêmes eaux, exige au contraire cette couleur, dans cette même tonalité, car il la considère comme indispensable pour réaliser une bonne pêche.

Dans la pratique, à quai et à bord des bateaux qui opèrent avec des filets maillants dérivants, on rencontre généralement des couleurs telles le jaune, le rose, le rouge et le marron, dans les tonalités les plus variées. Le bleu et le noir sont plus rares.

Quant aux couleurs en usage pour les filets à germon et les pélamidières, pour la pêche à la bonite, ce sont plus ou moins les mêmes, bien qu'elles soient généralement moins vives, plus ternes. Il est possible que ceci soit dû à la volonté du pêcheur ou bien, peut-être, au fait que les filets à germon et les pélamidières sont de vieux filets, en usage depuis plus longtemps.

En effet, l'essor de ces dernières années, qui a porté également à une augmentation de la production de nouveaux filets, n'a pratiquement concerné que les filets à espadon car, en ce qui concerne les pélamidières et les filets à germon, on continue à utiliser les vieux filets.

2.6. Lest et flotteurs.

Le filet maillant dérivant pour grands poissons pélagiques, du moins celui que les pêcheurs italiens ont utilisé jusqu'à présent, est un filet de surface. C'est-à-dire, en substance, que la ralingue supérieure se trouve entièrement en surface, car les flotteurs prédominent nettement par rapport au lest.

Le lest sert donc uniquement à assurer la descente de la ralingue inférieure, sans toutefois trop forcer car sinon, le filet serait trop tendu et verrait se réduire sa capacité de maillage. Ceci explique pourquoi des filets de grandes dimensions, comme les filets à espadon, portent, sur la ralingue, un poids très réduit, de l'ordre de 100 grammes au mètre.

Quant au type de lest monté sur la ralingue, on utilise soit de petites boules de plomb perforées au centre, que l'on enfille sur la ralingue, soit des ralingues lestées (avec le lest à l'intérieur). Ces dernières semblent être plus fonctionnelles, c'est pourquoi les filets neufs sont généralement armés avec une ralingue lestée.

Il est en effet évident que la ralingue lestée donne moins de problèmes, car le filet ne peut s'accrocher aux boules de plomb et, d'autre part, le filage et le virage s'avèrent plus faciles.

Quant aux flotteurs, il s'agit normalement des flotteurs traditionnels, en forme de disque ou de barillet, utilisés pour la pêche en surface. Ce sont d'excellents flotteurs, aussi bien du point de vue de leur matière, que de leur prix et de leur flottabilité, mais à condition de ne les utiliser qu'en surface. En effet, si l'on devait s'en servir pour pêcher entre deux eaux, à une certaine profondeur, la pression de l'eau tendrait à les écraser, et ils perdraient entièrement leur flottabilité.

Dans certains cas particuliers, rares, leur utilisation a provoqué quelques inconvénients. Comme on le sait, il n'est pas facile que le thon se prenne dans ce filet et souvent, il arrive même à le défoncer. Lorsque plus d'un exemplaire se trouve maillé dans le filet, il peut arriver que, dans la tentative de s'échapper, il entraîne avec lui le filet vers les profondeurs, d'où l'écrasement des flotteurs, dû à la pression. Dans des cas extrêmes, on peut même arriver à perdre le filet, puisqu'il n'en reste rien en surface et qu'il n'est relié à rien.

C'est pourquoi, parfois, certains pêcheurs utilisent des flotteurs pouvant supporter sans dommages de fortes pressions, même si cela implique des coûts majeurs et une flottabilité plus réduite.

2.7. Méthodes de filage et de virage.

On procède généralement au filage de l'engin de pêche le soir, on le laisse quelques heures dans l'eau, puis on le remonte.

Le filage est libre et il se fait tout simplement, en jetant une extrémité du filet à l'eau, pendant que le bateau avance à vive allure. Le frottement de l'engin sur l'eau entraîne le filet à la mer sans que l'équipage ait besoin d'intervenir.

Le filage est donc une opération très rapide, simple, qui ne demande aucune attention particulière sinon de contrôler que tout se déroule normalement, sans accrocs.

Le filage est fait en zigzag, afin d'éviter l'effet de "guidage", qu'en Italie on appelle "effetto pedale", du mot "pedale" qui, en italien, désigne une partie de la thonnaire servant à guider les thons pour qu'ils s'acheminent vers la chambre de capture. C'est une pièce de filet qui sert de barrière et oriente le poisson qui la rencontre vers la direction voulue, sans réaliser la prise elle-même.

Ainsi, afin d'éviter que le poisson puisse nager parallèlement au filet maillant tout le long de son parcours et reprendre ensuite sa route, on mouille le filet en zigzag en faisant de grands détours de façon à ce que le poisson ne

puisse nager parallèlement au filet et soit obligé, pour suivre les anses qu'il forme, de faire demi-tour ce que, normalement, il ne fait jamais. Ainsi, il tente de passer l'obstacle, s'approche de plus en plus du filet, dans lequel il finit par se prendre.

Le virage de l'engin de pêche est effectué au moyen d'un vire-filet, généralement situé à l'arrière du bateau.

Durant cette phase, la ou les hélices sont pratiquement arrêtées car il est préférable que ce soit le vire-filet lui-même qui tire le bateau vers le filet et vice-versa.

Notons qu'une particularité des bateaux destinés à la pêche aux filets maillants dérivants est de posséder, du moins pour les bateaux les plus modernes, plus d'une hélice, parfois trois dont deux plus grandes à droite et à gauche et une plus petite, au centre.

Il est certain qu'avec trois hélices (naturellement, toutes à pas fixe) le bateau présente une grande flexibilité de manœuvre. On parvient en effet à ajuster de façon très précise la vitesse alors que l'hélice tourne toujours (la plus petite, centrale, si l'on veut que le bateau avance lentement ; les deux plus grandes, latérales, si l'on souhaite aller plus vite), et il est possible à tout moment, en agissant sur les hélices, de modifier la direction du bateau, de façon simple et rapide.

Le filage se fait généralement à une vitesse d'environ 7 noeuds, alors que le virage du filet, s'il n'y a pas de prises et que l'équipage est bien entraîné, peut se faire en allant à 5 noeuds.

3. PRISES

Le filet maillant dérivant est, comme tous les filets maillants, un engin sélectif qui, parmi toutes les espèces présentes dans les eaux, n'en capture que certaines. Toutefois, bien qu'il s'agisse d'un type de filet assez sélectif par rapport à d'autres, il ne l'est pas assez selon nos goûts et ceux des pêcheurs.

Les espèces qu'il est possible de pêcher avec ce genre de filet peuvent se répartir en quatre catégories:

3.1. Espèces-cibles.

Les espèces principalement visées par l'utilisation de ces filets sont en nombre assez réduit. D'une manière générale, avec les filets à très grande maille (supérieure à 300-350 mm de longueur) on pêche l'espadon, alors qu'avec les filets à maille plus petite on recherche le germon, l'auxide, la bonite et les gros poissons appartenant à la famille des maquereaux.

Dans un cas comme dans l'autre, ces prises représentent un fort pourcentage des captures totales, aussi bien du point de vue du nombre que de celui du poids. Leur consistance et surtout, leur valeur commerciale sont la raison principale du développement de cette méthode de pêche.

3.2. Espèces secondaires recherchées.

Les espèces secondaires recherchées sont les espèces qui, bien qu'assez rares, peuvent être vendues sur le marché en tirant un bon profit. Bien sûr, elles ne suffiraient pas, à elles seules, à ce que la pêche soit économiquement rentable mais, le pêcheur les accepte volontiers, en supplément aux espèces-cibles.

Parmi ces espèces figurent certains types de requins, le *luvarus imperialis*, l'escolar (rouvet), et d'autres espèces mineures.

Comme nous l'avons déjà remarqué, la capture du thon est accidentelle, même si elle est cependant la bienvenue. Bien qu'étant robuste, le filet n'est généralement pas assez solide pour prendre le thon.

3.3. Espèces secondaires indésirables.

Les espèces secondaires indésirables sont celles qu'on se trouve parfois prises dans le filet, par hasard, et dont la valeur commerciale est faible, voire nulle.

Leur capture s'avère indésirable car leur démaillage fait seulement perdre du temps et elles n'apportent aucun profit.

Il faut ranger, parmi les espèces secondaires indésirables, la mante, le poisson-lune et, d'une manière générale, tous les requins d'une faible valeur commerciale.

3.4. Les espèces protégées.

Très rarement, il arrive malheureusement que des mammifères marins ou des tortues de mer se trouvent pris dans les filets

dérivants. Il s'agit là d'espèces protégées, ce qui crée des tensions entre les pêcheurs qui pratiquent cette pêche et les organes de contrôle ou les mouvements écologistes.

Il s'agit toujours de prises accidentelles, non voulues, mais malheureusement souvent mortelles pour l'animal capturé.

En soi, le filet ne fait que retenir l'animal sans le tuer mais ces animaux ont aussi besoin de respirer de l'air à intervalles réguliers et doivent pour cela remonter à la surface. Ces animaux sont également dotés d'une forte énergie et essaient par tous les moyens de se libérer du filet. Mais le filet est comme une toile d'araignée: plus on s'y agite, plus le piège se referme. Ces animaux finissent donc par être complètement emmêlés dans le filet, sans plus pouvoir bouger, ne parviennent pas à remonter à la surface, et s'asphyxient. C'est pourquoi, le plus souvent, ils sont déjà morts lorsqu'on les ramène à bord.

Si, au contraire, on vire le filet peu après la capture de l'animal, il est possible qu'il soit encore vivant et on peut alors le libérer en coupant le filet, ce que les pêcheurs font toujours, même si cela demande du temps et de l'énergie et bien qu'il soit alors nécessaire d'abîmer une partie du filet. Malheureusement cette circonstance semble assez rare.

D'après les informations que l'on a, la capture d'un animal mort semble, elle aussi, peu fréquente mais il est difficile de quantifier ce phénomène.

Effectivement, étant donné qu'il s'agit d'espèces protégées, les pêcheurs évitent de répandre la nouvelle d'une telle prise; ils essaient même souvent de faire disparaître la carcasse de l'animal en la faisant couler à pic. C'est ainsi que l'on trouve parfois des dauphins morts et mutilés, en mer ou sur les plages. Il ne s'agit pas de maltraitements infligés aux animaux par les pêcheurs; cela est dû au fait qu'ils essaient d'être le plus rapides possible.

En effet, s'il arrive, lorsqu'on récupère un filet, d'y trouver prisonnier un dauphin déjà mort, afin d'aller plus vite pour libérer l'animal et aussi pour ne pas trop endommager le filet, étant donné qu'en essayant de se libérer l'animal s'y est complètement empêtré, on coupe la queue et les nageoires du dauphin mort et on l'abandonne en mer.

Comme nous l'avons déjà écrit, il n'existe pas de données précises concernant le nombre des animaux protégés morts à cause des filets dérivants. Des recherches sont en cours afin de quantifier ce phénomène mais, afin d'obtenir des données précises (pour autant qu'elles puissent l'être), nous devons attendre l'issue de ces études, même si certains chercheurs ont déjà tenté d'évaluer l'ampleur de l'impact des filets dérivants sur les dauphins et les tortues de mer.

4. PROBLEMES CAUSES PAR CE TYPE DE PECHE ET CONSIDERATIONS SOCIO-ECONOMIQUES.

L'utilisation des filets dérivants mouillés en surface, comme ceux que les pêcheurs italiens utilisent, détermine une série de problèmes d'ordre biologique et technique liés à l'exploitation de la mer en général.

Lorsqu'on aspire à diminuer la gravité des problèmes qui se posent, on rencontre souvent sur son chemin des difficultés socio-économiques ou de gestion de la pêche, et il n'est donc pas aisé de trouver des solutions. Essayons de comprendre, par une analyse plus approfondie, la complexité de la pêche aux filets maillants dérivants.

4.1. Filets dérivants et captures.

Le prix élevé de l'espadon, ainsi que la grande capacité de capture des filets dérivants, ont porté, surtout ces dernières années, à un important développement de ce type de pêche.

D'après des informations recueillies dans le cadre des recherches sur les grands poissons pélagiques, on peut déduire que le nombre des embarcations qui opèrent avec des filets dérivants se monte à plusieurs centaines.

Si l'on considère, d'une part, la capacité de travail de chaque embarcation (on parle de 20 kilomètres de filet par bateau et par jour) et, d'autre part, le manque de limitations législatives qui a régné jusqu'à l'an dernier, on comprend aisément l'ampleur de l'effort de pêche sur l'espadon et les autres espèces que l'on capture à l'occasion.

Les chercheurs se montrent préoccupés non seulement par la capture accidentelle d'espèces protégées mais aussi, à cause de la consistance des bancs d'espadons qui sont la cible principale de ce type de pêche.

Ainsi, pour l'espadon également, on ressent la nécessité d'une réglementation qui évite une éventuelle diminution des prises liée à un effort de pêche excessif. Il est clair qu'en limitant la pêche à l'espadon, on limitera aussi, automatiquement, l'impact des filets maillants dérivants sur les espèces protégées.

4.2. Filets dérivants et autres activités présentes en mer.

La mer n'est pas seulement un lieu de pêche; on y exerce aussi d'autres activités, dont certaines peuvent interférer avec celles des filets dérivants. En voici quelques exemples:

Le filet dérivant de surface représente un obstacle à la navigation.

Toutefois, si les filets dérivants se trouvaient en nombre limité et si on les mouillait en utilisant les signaux adéquats, ils pourraient facilement être évités. Cependant, rappelons que le filet se trouve généralement à l'eau durant la nuit. Donc, bien qu'il soit tout à fait visible de jour, puisqu'il s'agit d'un filet de surface, il devient en revanche difficile à localiser lorsqu'il fait nuit.

En outre, dans certaines zones, le nombre de ces filets est si élevé qu'il crée un véritable labyrinthe duquel il est difficile de sortir, même avec la meilleure volonté du monde.

Si un bateau s'y trouve prisonnier, deux circonstances peuvent se vérifier. L'hélice peut couper la ralingue supérieure, auquel cas le bateau passe alors sans problème, ou bien, la ralingue inférieure s'enroule autour de l'hélice, de même que le filet lui-même. L'hélice continuant à tourner, le nylon fond à cause de la friction et bloque entièrement l'hélice, immobilisant le bateau et détruisant le filet.

C'est la raison pour laquelle la ralingue supérieure est si fine: elle doit se trancher au premier coup d'hélice, sans résister, pour ne pas bloquer le bateau ni rompre le filet.

La situation n'est qu'apparemment meilleure en ce qui concerne les bateaux à voile, qui n'ont pas d'hélice mais sont par contre munis d'une dérive assez grande qui se prend inévitablement dans les filets dérivants, et empêche le bateau de se libérer.

Naturellement, les pêcheurs qui montent la garde sur leurs filets ou qui se trouvent à les virer, essaient de défendre leurs engins en se mettant en contact avec les bateaux en approche et en les avertissant par radio de la présence du filet et de la route à suivre pour éviter tout accident.

Cette précaution, apparemment sage, provoque un autre inconvénient: l'occupation des canaux radio, à certaines périodes utilisés uniquement dans ce but, qui rend difficile les communications à d'autres fins.

Enfin, il ne faut pas sous-estimer l'interaction entre la pêche aux filets dérivants et les activités touristiques, qu'il s'agisse de navigation de plaisance ou de tourisme du littoral.

Pour la navigation de plaisance, les inconvénients sont les mêmes que ceux de la navigation en général, avec une circonstance aggravante en plus, qui réside dans le nombre d'embarcations circulant en mer, d'où une interférence très probable avec les filets dérivants, également très nombreux.

Les bateaux qui pêchent l'espadon et dont le port d'attache se situe dans les régions méridionales de la Mer Tyrrhénienne,

se déplacent pour suivre l'espadon et atteignent ainsi, parfois, des zones très éloignées de leur port de référence, faisant halte dans différents ports.

Il arrive ainsi qu'à certaines périodes des centaines de bateaux "envahissent" un port d'habitude très tranquille, que les touristes avaient justement choisi pour cette même raison.

La présence de nombreux bateaux pêchant l'espadon et de leurs équipages dénature complètement les caractéristiques de la ville où ce port se trouve, surtout les jours où ils restent à quai à cause des conditions météorologiques. Ceci peut créer et a effectivement créé, parfois, des tensions entre les opérateurs touristiques et les touristes d'une part, et les pêcheurs d'autre part.

4.3. Considérations socio-économiques.

La pêche à l'espadon est une activité économiquement très importante pour l'Italie; L'espadon est très demandé et son exploitation fournit de l'emploi à de nombreuses personnes.

La capture de ce poisson, très importante pour l'économie de notre pêche, se fait principalement au moyen d'un filet dérivant spécial, alors que l'utilisation d'autres filets traditionnels (comme les "passirelle" italiennes) est désormais très limitée, de même que celle des palangres dérivantes, qui ne sont pas automatisées.

Les pêcheurs italiens ont donc la nécessité de continuer à pêcher l'espadon mais aussi, celle d'y procéder de façon rationnelle et donc, ils souhaitent vivement que cette pêche soit réglementée.

Il n'est pas facile de mettre en pratique la proposition qui a été faite de recycler ces pêcheurs en leur faisant adopter d'autres systèmes de pêche comme, par exemple, la palangre dérivante à espadon.

L'utilisation de la palangre demande une certaine expérience, que les pêcheurs n'ont pas toujours. On a besoin d'appâts, ce qui implique des coûts considérables et, en outre, cela crée de nouveaux inconvénients à la fois pour l'espadon lui-même et pour certaines espèces protégées.

En effet, même avec la réglementation des périodes de pêche, la palangre dérivante comporte la prise fréquente de jeunes exemplaires d'espadon et peut, si on l'utilise trop à outrance sans appliquer une réglementation adéquate, créer des dommages à l'espèce en question.

Enfin, parmi les espèces protégées, les plus fréquemment capturées par la palangre sont les tortues. En effet, si dans les filets maillants dérivants il est plus probable de trouver un dauphin qu'une tortue de mer, dans le cas de la palangre, c'est le contraire qui advient.

Donc, le problème de l'impact sur les espèces protégées ne peut être entièrement effacé et résolu en favorisant l'utilisation de la palangre;

5. CONCLUSION.

L'espadon représente, pour notre pêche, une importante ressource, que l'on doit mettre en valeur de façon rationnelle.

A cet effet, il est nécessaire de mettre en oeuvre toutes les mesures pouvant sauvegarder cette ressource et réduire au minimum l'impact sur les autres animaux de mer ou sur les autres activités humaines en mer, qui sont aussi importantes, sinon plus.

C'est pourquoi des recherches sont actuellement en cours en Italie, confiées à quatre organismes différents, afin d'évaluer l'impact des filets à espadon sur les espèces marines protégées et de trouver des solutions tendant à réduire cet impact.

Les résultats de ces recherches permettront d'établir une réglementation précise et rigoureuse portant aussi bien sur les engins de pêche que sur les modalités de leur utilisation, les périodes et zones de pêche, que sur l'effort global de pêche concernant cette ressource.

Dans l'attente de ces résultats, il a été défini une réglementation temporaire qui limite les périodes et les zones de pêche, ainsi que les dimensions des engins qu'il est autorisé d'employer. Ces restrictions des zones et des périodes, la sauvegarde de certaines zones et la limitation de la longueur du filet à 5 milles par jour et par bateau, ne peuvent qu'avoir des effets bénéfiques sur cette ressource qu'est l'espadon, sur la capture accidentelle d'espèces protégées et sur les autres activités humaines en mer.

Tableau: Caractéristiques des filets maillants dérivants pour les grands pélagiques

TYPE DE FILET	RAPPORT D'ARMEMENT FLOTTEURS	RAPPORT D'ARMEMENT PLOMB	COULEUR	MAILLE mm	MASSE LINEIQUE	PLOMB g/m	HAUTEUR DU FILET mètres
1) ESPADON (Sicile orientale)	0,97	1,05	Rouge - Brun	400/420	1550	80	30/31,50
2) GERMON (Sicile orientale)	0,95	0,95	Sale	160	750/800	80	24
3) ESPADON (Sicile nord)	0,95	1,05	Rouge - Brun	400/420	1400/1750	80	28/33,50
4) GERMON (Sicile nord-orientale)	0,96	1,08	Rouge - Brun - Ocre	180	750/800	80	23,40
5) ESPADON (Sicile nord-orientale)	0,94	1,00	Sale	340	1400	100	27,20
6) ESPADON (Sicile orientale)	0,95	1,05	Rouge - Brun	420	1400	80	31,50
7) GERMON (Sicile orientale)	0,95	1,00	Sale	165	700/750	80	23,10
8) ESPADON (Sicile orientale)	0,95	1,05	Rouge - Brun	410	1400/1500	100	30,75
9) ESPADON (Calabre Tyrrhénienne)	0,99	1,01	Rouge - Brun - Rose - Bleu	400/460	1300/1600	100	32,00/32,20
10) ESPADON (Calabre Tyrrhénienne)	0,97	1,01	Rouge - Lilas	410	1300/1600	100	32,8

ALGERIE

RAPPORT NATIONAL: LA PECHE THONIERE

par

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Abstract

Tuna fishing is not common in Algeria. Information on resources and catches are scarce and not reliable but it is usually admitted that Algeria remains the only Mediterranean country that does not fully exploit its share of Mediterranean stocks. However series of actions are undertaken since 1989 in view of a better assessment of the resources, and its variability. An experimental fishing trip was undertaken.

RESUME

La Pêche aux thonidés est très peu pratiquée en Algérie. Aussi, vu la disparité des résultats obtenus sur le terrain et les données très peu fiables enregistrées on ne peut se faire une idée exacte sur la pêche thonière. L'absence d'une exploitation rationnnelle de cette ressource s'explique par des difficultés d'ordre matériel sur le terrain. On peut dire que l'Algérie reste le seul pays méditerranéen à ne pas prélever la quote part qui lui revient de cette ressource pour qui ses eaux restent un passage obligé pour les thonidés en général. Cependant depuis 1989 on assiste à de sérieux efforts qui sont entrepris en vue de mieux connaître la dynamique de cette ressource par l'acquisition d'équipements, la mise en place d'une campagne de pêche expérimentale mixte et un programme d'échantillonnage et de collecte de données.

1. INTRODUCTION

Bien qu'une ressource atlanto-méditerranéenne non négligeable ait été identifiée, et que des passages obligés de thonidés se font en Algérie, la pêche de ces espèces n'a pas connu de développement important.

Les données reproduites dans ce document sont très partielles du fait de l'absence encore de la mise en place d'un programme d'échantillonnage de ces espèces. Depuis 1989, seule une espèce l'espadon (Xylas gladius) est échantillonnée au niveau de deux ports les plus importants (Bénisaf à l'ouest du pays et Bou Haroun au centre).

La production réalisée est très faible, ceci étant du essentiellement à l'absence de moyens de pêche importants tels que les thoniers-senneurs.

Aucune donnée biologique ne sera mentionnée dans ce document du fait meme que les prises sont faibles et très dispersées dans le temps et dans l'espace.

2. LA FLOTILLE ET MOYENS DE PECHE

Senneurs: Ce sont surtout des senneurs de 13 à 20 mètres destinés à la peche aux petits pélagiques (sardine et anchois). Actuellement environ quatre thoniers senneurs d'une longueur de 22 à 25 mètres sont en cours de réalisation et seront globalement en activité fin 1991 début 1992. Les peches en petits thonidés (bonites) représentent 30 pour cent de la pêche thonière.

Petits métiers: Au nombre de 700 unités ils sont en majorité armés pour la peche des espèces démersales avec des filets trémails et filets maillants. Seules quelques unités

(100) sont armées aux palangres et bonitières et pechent environ 60 pour cent de la production de thonidés toutes espèces confondues.

La taille de ces unités de pêche varie de 6 à 10 mètres.

La madrague: Une seule madrague est connue en Algérie celle de Kristel (W. d'Oran) à l'ouest du pays. Abandonnée depuis très longtemps, elle fut utilisée en 1976 seulement puis reprise à partir de 1988. Ces apports sont de l'ordre de 50 à 60 tonnes par an et touchent essentiellement les bonites, melva, bacorete et thon rouge.

3. LA PRODUCTION ET ESPECES

Globalement et tous types de pêche confondus, la production représente environ 500 tonnes en moyenne et par an.

La pêche de thonidés par les petits métiers représente 60 pour cent, 9 pour cent pour la madrague, et 20 pour cent pour les senneurs.

Les espèces sont représentées essentiellement par:

- Bonite à dos rayé (Sarda sarda)
- Bacorete (Enthynnus alteratus)
- Melva (Auxis thazard)
- Thon rouge (Thunnus thynnus)

L'espadon (Xylas gladius) est pêché essentiellement aux palangres tandis que celles énoncées au dessus sont prises soit à la madrague soit aux filets bonitières et à quelques rares exceptions par les sardiniers.

Il est à noter que de très faibles prises accidentelles sont faites par les chalutiers (1 pour cent).

4. LES FILETS MAILLANTS DERIVANTS

Ils ne sont pratiquement pas utilisés en Algérie. Toutefois, un seul filet dérivant d'une longueur de 3 km de long et 3 mètres de profondeur est utilisé à titre expérimental dans la région d'Oran à l'ouest du pays. Les résultats obtenus sont encore très partiels et on note cependant une prise moyenne de 10 à 12 d'espadons par sortie. Aucune prise d'autres espèces n'a été enregistrée. De même que jusqu'à présent aucune incidence négative sur les cétacées n'a été constatée.

L'aspect expérimental de ce filet réside uniquement dans le but de suivre ces incidences sur les autres pêcheries et sur l'équilibre des espèces menacées et à protéger telles que les cétacées. Ceci va permettre de dégager également les éléments nécessaires au cadre juridique de son utilisation ou de sa limitation dans le temps et dans l'espace.

5. ECHANTILLONNAGE/COLLECTE DES DONNEES

Mise à part quelques travaux sur l'espadon (Xyphias gladius) il n'y a pas pour le moment de programme d'échantillonnage sur les thonidés en général. Cependant dans le cadre d'une campagne de pêche expérimentale aux thonidés, à l'aide de thonier senneurs et organisée conjointement entre l'entreprise nationale des pêches et Cofrepeche (société française) le centre de recherche pêche mettra en place un programme d'échantillonnage à partir de 1991.

La collecte des données sur le terrain est faite conjointement par le service des pêches désigné à cet effet et les stations expérimentales du centre de recherche (CERP) en Algérie.

Il est à noter que les statistiques contenues dans ce document ne concernent que les années 1986, 1987 et 1988 pour lesquelles un effort de collecte a été effectué sur le terrain. Cependant pour les années antérieures à 1986 et contenues dans d'autres documents (ICCAT) ont été établis sur la base d'estimations faites à partir d'anciens documents et d'information sur le terrain (chiffre à prendre avec beaucoup de réserve).

6. CONCLUSION

La pêche aux thonidés en Algérie représente une ressource non négligeable qu'il faut développer et organiser. Certaines mesures doivent être prises en ce sens à savoir:

- le développement d'une flottille de thoniers senneurs en nombre limité vers les ports où la ressource et l'infrastructure sont disponibles,
- la mise en place d'un réseau statistique sur la collecte des données en ce qui concerne les principales espèces de thonidés,
- la mise en place d'un programme d'échantillonnage sur le thon rouge et l'espadon,
- la mise en place d'une campagne de pêche expérimentale avec démonstration et formation du personnel algérien,
- la mise à la disposition des petits pêcheurs des moyens matériels et équipements en quantités suffisantes (palangres, filets bonitières, etc.),
- l'exploitation continue et suivie plus rationnelle des apports réalisés par la madrague,
- l'établissement des relations d'échanges et de coopération scientifique et technique avec d'autres pays de la Méditerranée et développer un cadre de concertation régional,
- la mise en place de textes réglementant l'usage de tous les engins de pêche aux thonidés ou de leur interdiction sur la base de résultats expérimentaux et permettre un état d'équilibre du stock.

SIZE DISTRIBUTION, LENGTH-WEIGHT RELATIONSHIPS, AGE AND SEX
OF ALBACORE, THUNNUS ALALUNGA BONN., IN THE AEGEAN SEA

by

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ABSTRACT

The Sporades basin of the Aegean Sea presents a suitable trophic area of concentration for albacore, Thunnus alalunga Bonn. The size frequency distribution of the catches from 1986 to 1989 showed that the albacore stock is mostly made up of small specimens with fork lengths between 54 and 89 cm and estimated ages from 1 to 6 years. Length-weight relationships for males and females showed no appreciable difference between the sexes. Gonads examination indicated the presence of both immature and adults individuals. Males were more numerous and the sex ratio of females to males was 1:2.1.

INTRODUCTION

Albacore, Thunnus alalunga Bonn., is one of the large pelagic fish species exploited in Greece. Its distribution in the Aegean Sea is discontinuous, with a higher concentration mainly in the north between the Sporades islands and the peninsula of Chalkidiki where the most important Greek albacore fishing fleet has been operating for several years.

The albacore stock is mostly formed by small individuals which arrive in the above-mentioned area usually at the end of August and remain there in surface waters until the end of November.

Preliminary data on fishing grounds, fishing period, total catch and size distribution are reported by DE METRIO et al. (1988), but there are no data on the age structure or other characteristics of the stock in this area. Age estimates have been made for albacore in the central Mediterranean using the scales (CEFALI et al., 1982). Some other estimates were performed in the Atlantic using different methods (BEARDSLEY, 1971; BARD, 1974; GONZALEZ-GARCES and FARINA-PEREZ, 1983).

The present study is a first approach to evaluating the age and the growth of albacore caught in the Aegean Sea using the scales and to provide information on size-frequency distribution, age distribution, sex and growth in weight. Data on the albacore landings from 1982 to 1989 are also reported.

MATERIALS AND METHODS

Data on the catches and the number of vessels are derived from the data archives of the Alonisos fishermen's cooperative.

A total of 1886 albacore, caught by the fishing fleet of Alonisos island, were measured during the autumn in 1986, 1987 and 1989. Measurements of fork length (FL), to the nearest centimetre, and total weight to the nearest tenth of a kilogramme were taken at the port of Alonisos. Length-weight relationships were established using regression analysis.

The fresh gonads of 363 specimens were examined in order to estimate the sex and sexual maturity.

Scales were collected from 219 fish. Date of capture and fork length (FL) were recorded for each specimen. For the age estimation, reading of the scales was performed using an optical microscope. The average fork lengths at age were calculated.

RESULTS

Catches and Size-Frequency Distribution

Numerous small size boats are involved in the albacore fishery every year, which is mainly carried out by troll-line. Surface longline is also used by some vessels. Although the number of vessels is stable since 1982, landings have decreased in the last four years (Table I).

A study of the size-frequency distribution was made on 867, 379 and 639 fish in 1986, 1987 and 1989, respectively. The length-frequency distributions are shown in Figure 1, and the weight-frequency distributions are shown in Figure 2. The average lengths and weights as well as the standard deviations, the minimum and maximum values are calculated for each year (Table II).

Maturity of Gonads, Sex-Ratio

A total of 363 albacore were examined for gonad maturity and the sex ratio. No individuals with ripe gonads were found. A lot of spent gonads were found.

A prevalence of males (67.8%) was observed. The prevalence of males is evident in the size range from 68 to 87 cm. Females are more numerous for lengths less than 68 cm. No female longer than 77 cm was found (Fig.3). The calculated ratio of females to males was 1:2.1.

Length-Weight Relationship

Length-weight relationships, which are essential for the purpose of raising size data, were developed for each year. Relationships were also developed for males and females separately. The range of fork lengths, on which these are based, the sample size and the a, b and r values are presented in Table III.

Length-weight relationships for males and females show no appreciable difference over the range of the fish sampled (males 58.7-87 cm and females 61.5-77 cm). Furthermore, when the fitted curves are extrapolated beyond the sampled lengths (Fig.4), the relationships do not differ. No appreciable difference were observed between the other length-weight relationships (Table IV.)

Age Estimation

The fork length (FL) of the albacore samples used for age estimates ranged from 54.8 to 82 cm and the estimated ages were from 1+ to 6+ years. The smallest specimen of the sample was 1+ year old, while the largest was 4+ years old. A size-age key for 219 albacore grouped in size classes of 2 cm is given in Table V.

The age classes most frequent in the sample were classes II, III and IV with a percentage of 37.9%, 39.7% and 17.8%, respectively. Very few individuals, practically 4.6% of the sample, were estimated as belonging to the age classes I, V, and VI.

The lengths at age were estimated and the results are given in Table VI. Length frequencies by estimated age classes are illustrated in Figure 5.

DISCUSSION

The albacore fleet of Alonisos has operated in the Sporades basin for several years and is directed at different species according to the season of the year. Catches of albacore varied within a range of 10943 -73920 kg, with an annual average of 49023 kg during the 1982-1989 period. Since 1986 landings were greatly reduced and stabilized at approximately 40000 kg in the following years.

The size distributions in 1986, 1987 and 1989 shown in Figure 1 show that the bulk of the catches in the Sporades basin of the Aegean Sea is made up of small specimens. The average FL and weight values for 1986 and 1987 coincide (68 and 67.6 cm; 5.8 and 5.7 kg) whereas in 1989 the comparable values are higher (72.6 cm, 7.2 kg). Most of the fork lengths ranged from 62 to 72 cm in the first two years whereas in the last year, they ranged from 66 to 78 cm. The presence of larger individuals is evident in the catches of the last year.

A review of the Italian albacore catches in the Gulf of Taranto and in the Adriatic Sea in recent years (De Metrio et al., 1987 Marano et al., 1987) indicates that the size composition of the catches in the Aegean Sea and in some other areas of the Mediterranean Sea are more or less similar. However, the catches in the Atlantic comprise larger specimens compared with those of the Aegean. Annual mean length of albacore sampled by ICCAT in different Atlantic ports in 1975-1986 ranged from 84.9 cm to 105 cm (ICCAT, 1990).

These considerations indicate that the populations exploited in different areas of the central and eastern Mediterranean are made up of smaller specimens.

In spite of the clear prevalence of males in the catches, most of the small individuals are females. The prevalence of males is remarkable, especially among the larger specimens while the females are more numerous among the smaller ones. There is no information on the albacore sex composition in other areas of the Mediterranean Sea; however, the dominance of males over females has also been verified for the Atlantic albacore. In 1970 Lam Hoai, using histological observations of the gonads, found the sex ratio to be 1 female for 2 males in the N.E. Atlantic; Nepgen found a numerical dominance of males (64.1%) over females in the S.E. Atlantic (LE GALL, 1974). In 1971 BEARDSLEY examined 598 albacore in Porto Rico and found that the 61% of the specimens were males; in addition, he observed a complete absence of females with lengths over 105 cm. As regards the albacore of the surface waters, BARD reported a lighth prevalence of females (52%) over males (LE GALL, 1974).

The examination of the gonads showed that the population of the albacore in the Sporades basin comprises immature and adult individuals which have already spawned probably during the summer in another spawning area. The Sporades basin, because of its favourable hydrological and ecological conditions and the abundance of the food, presents a suitable trophic area of concentration for the albacore.

Length-weight relationships for males and females show no appreciable difference between the sexes even when the fitted curves are extrapolated beyond the sampled lengths. It is evident (Table III) that, for a given length, males and females have the same weight so the length-weight relationships established for the Aegean albacore cannot demonstrate the existence of a dimorphism. Bard's (1971) relationships for males and females show no appreciable difference over the range of 85-115 cm, whereas concerning larger fish, females are heavier than males. In addition, a comparison between our relationships and those of Bard demonstrates a remarkable difference, especially for the large individuals (at a given length, Atlantic albacore are heavier than the Aegean ones). The same fact was also verified for the other relationships established for the Atlantic albacore using different samples (Table III). However, our length-weight relationships are very similar to those found in the Pacific -by Liu and Hsu in 1989- and Indian Oceans -by Lee and Kuo in 1988 (ICCAT, 1990).

Taking into account the very limited number of the individuals in the sample, smaller than 60 cm and bigger than 76 cm, we do not consider the estimates of the length at age for the classes I, V and VI as being representative. It is

obvious that a sample including more individuals in the extreme length classes should be studied. Furthermore, results obtained by various authors using the same or different methods differ; so, given the importance of a correct age estimation for the stock assessment, the method used must be validated. However, according the estimated size-age key, we suppose that the age structure of the albacore catch in the Sporades basin could be as follows:

AGE CLASS	1986	1987	1989
II	39.3%	37.5%	14.2%
III	41.8%	39.9%	33.6%
IV	12.8%	12.2%	40.3%

Most of the catch consists of individuals of the second, third and fourth age classes.

ACKNOWLEDGMENTS

This study is a part of a Ph.D thesis which is carried out at the University of Athens, Department of Zoology with the colaboration of the University of Bari, Department of Animal Production.

I wish to thank the professors C. Yannopoulos and G. De Metrio for their valuable suggestions and assistance in all the phases of this work.

I also thank the Alonisos fishermen's cooperative for the cooperation on the collections of the albacore samples.

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Table I. Albacore catches by the fishing fleet of Alonisos from 1982 to 1989

Year	Number of vessells	Catches in kg	Catches in number
1982	52	73249	12629
1983	53	73920	12745
1984	52	10943	1887
1985	57	71624	12349
1986	48	41350	7129
1987	54	35791	6279
1988	42	41486	7153
1989	51	43820	6086

Table II. Fork length and weight data for albacore in the Aegean sea.

YEAR	FORK LENGTH				W E I G H T			
	Mean	Min	Max	St.Dev.	Mean	Min	Max	St.Dev.
1986	68.0	54.5	81.8	4.21	5.8	3.0	9.8	1.04
1987	67.6	58.2	81.7	3.77	5.7	3.7	10.0	0.99
1989	72.6	58.7	89.0	4.56	7.2	4.2	14.5	1.86

TABLE III. Length-weight relationships for albacore in the Aegean Sea

	No samples	size range	a	b	r
1986	501	55.5-81.8	3.561xE-5	2.84	0.97
1987	379	58.2-81.7	3.317xE-5	2.86	0.94
1989	496	58.7-89.0	5.618xE-5	2.74	0.94
males	164	58.7-87.0	4.344xE-5	2.80	0.96
females	87	61.5-77.0	4.178xE-5	2.81	0.95
total	1742	55.5-89.0	3.119xE-5	2.88	0.96

Table IV. Fork lengths (cm) and weights (kg) calculated from the five equations in Table II. The sixth relationship (SCRS/84/64) is for Atlantic albacore (ICCAT, 1990)

FL	WEIGHT						SCRS/84/64
	Females	Males	1986	1987	1989	TOTAL	
40	1.31	1.32	1.26	1.27	1.38	1.28	1.48
42	1.50	1.51	1.45	1.46	1.57	1.48	1.71
44	1.71	1.72	1.66	1.66	1.79	1.69	1.96
46	1.94	1.95	1.88	1.89	2.02	1.92	2.23
48	2.19	2.20	2.12	2.13	2.27	2.17	2.52
50	2.45	2.46	2.38	2.40	2.54	2.44	2.84
52	2.74	2.75	2.66	2.68	2.83	2.73	3.18
54	3.05	3.06	2.96	2.99	3.14	3.04	3.55
56	3.37	3.38	3.28	3.32	3.46	3.38	3.95
58	3.72	3.73	3.63	3.67	3.81	3.74	4.38
60	4.09	4.10	3.99	4.04	4.18	4.12	4.83
62	4.49	4.50	4.38	4.44	4.58	4.53	5.32
64	4.91	4.92	4.80	4.86	4.99	4.96	5.84
66	5.35	5.36	5.24	5.30	5.43	5.42	6.38
68	5.82	5.82	5.70	5.78	5.90	5.91	6.97
70	6.31	6.32	6.19	6.28	6.38	6.43	7.58
72	6.83	6.83	6.70	6.80	6.90	6.97	8.23
74	7.38	7.38	7.25	7.36	7.43	7.54	8.92
76	7.95	7.95	7.82	7.94	8.00	8.14	9.64
78	8.55	8.55	8.42	8.55	8.59	8.77	10.40
80	9.18	9.18	9.04	9.20	9.20	9.44	11.19
82	9.84	9.83	9.70	9.87	9.85	10.13	12.03
84	10.53	10.52	10.39	10.57	10.52	10.86	12.91
86	11.25	11.24	11.11	11.31	11.22	11.62	13.82
88	12.00	11.98	11.86	12.08	11.95	12.42	14.78
90	12.78	12.76	12.64	12.88	12.71	13.25	15.79
92	13.59	13.57	13.45	13.71	13.50	14.12	16.83
94	14.44	14.41	14.30	14.58	14.32	15.02	17.92
96	15.32	15.29	15.18	15.49	15.17	15.96	19.06
98	16.23	16.19	16.09	16.43	16.05	16.93	20.24
100	17.18	17.13	17.04	17.41	16.97	17.95	21.47
102	18.16	18.11	18.03	18.42	17.91	19.00	22.75
104	19.18	19.12	19.05	19.47	18.89	20.01	24.07
106	20.23	20.17	20.11	20.56	19.90	21.23	25.45
108	21.32	21.25	21.21	21.69	20.95	22.40	26.88
110	22.44	22.37	22.34	22.86	22.03	23.61	28.36
112	23.61	23.53	23.51	24.07	23.14	24.87	29.89
114	24.81	24.72	24.73	25.32	24.29	26.18	31.47
116	26.06	25.96	25.98	26.61	25.48	27.52	33.11
118	27.34	27.23	27.27	27.95	26.70	28.91	34.80
120	28.66	28.54	28.60	29.32	27.96	30.34	36.55

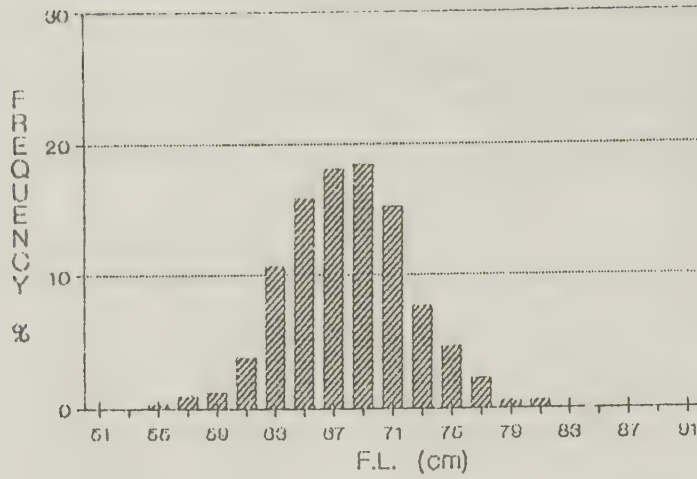
Table V. Size-age (estimated) key of the 219 albacore studied.
The fork length (FL) is regrouped in classes of 2 cm.

FL (cm)	Estimated age							TOT
	0+	1+	2+	3+	4+	5+	6+	
54-56		1	1					2
56-58		3						3
58-60			2					2
60-62			8	1				9
62-64			20		1			21
64-66			31	10				41
66-68			16	23	1			40
68-70			5	32	1			38
70-72				15	11			26
72-74				4	12			16
74-76				1	10	2		13
76-78					1	1		2
78-80				1	1	2	1	5
80-82					1			1

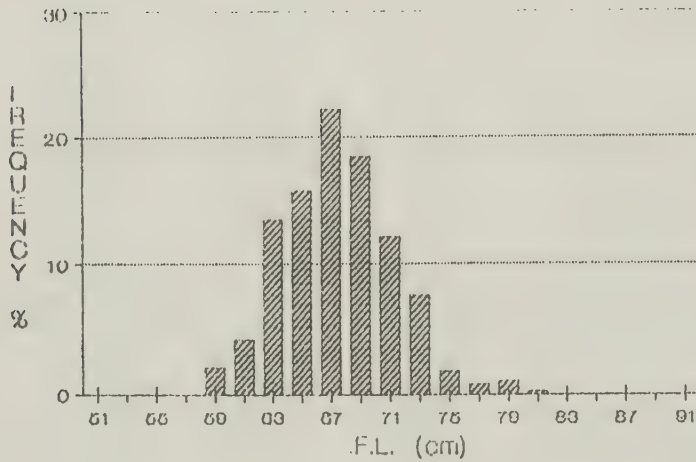
Table VI. Average fork length by age class and standard deviation.

AGE CLASSES	samples	FL (cm)	st.deviation
I	4	56.5	0.8
II	83	64.5	2.5
III	87	68.8	2.6
IV	39	73.0	2.9
V	5	77.0	1.5
VI	1	79	-

alonisos 1986



alonisos 1987



alonisos 1989

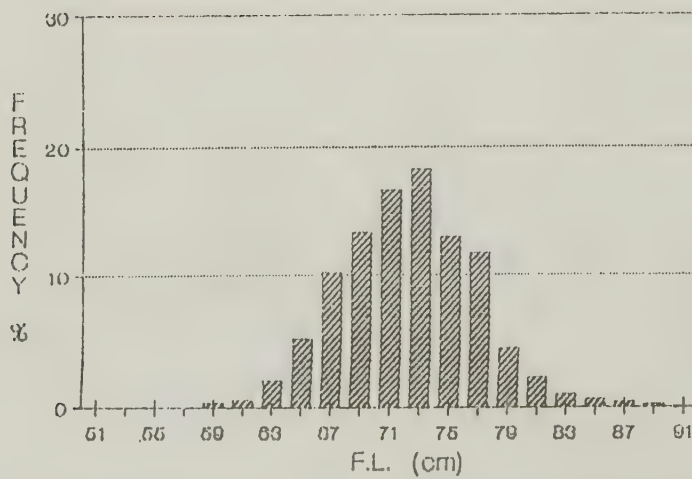
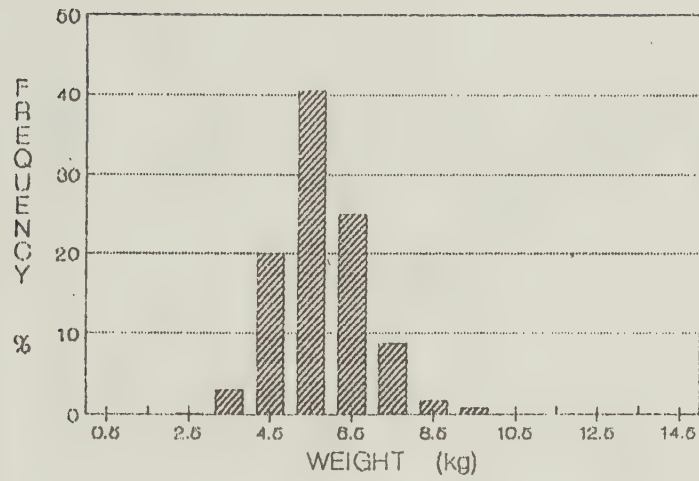
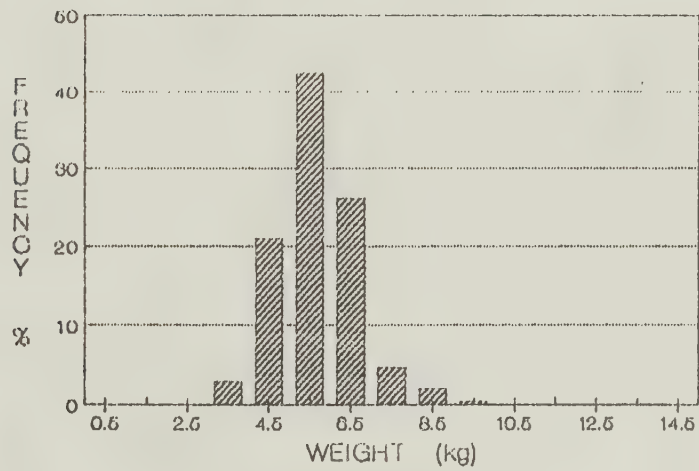


Fig. 1 Length frequency (FL) distribution of albacore in the Aegean Sea in 1986 - 1987 - 1989.

alonisos 1986



alonisos 1987



alonisos 1989

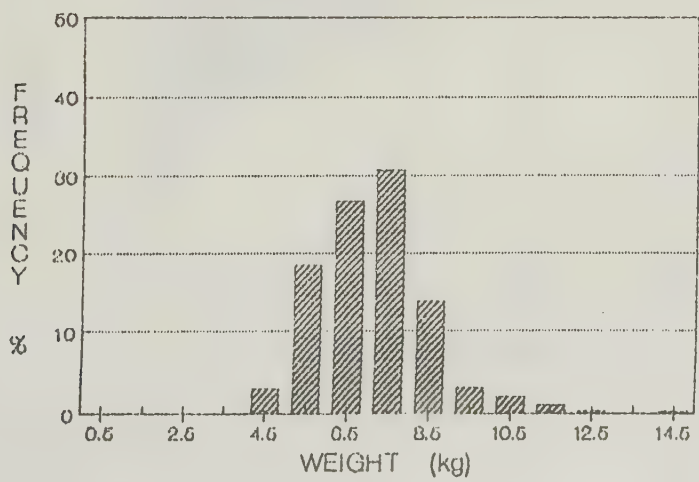


Fig. 2 Weight frequency distribution of albacore in the Aegean Sea in 1986 - 1987 - 1989.

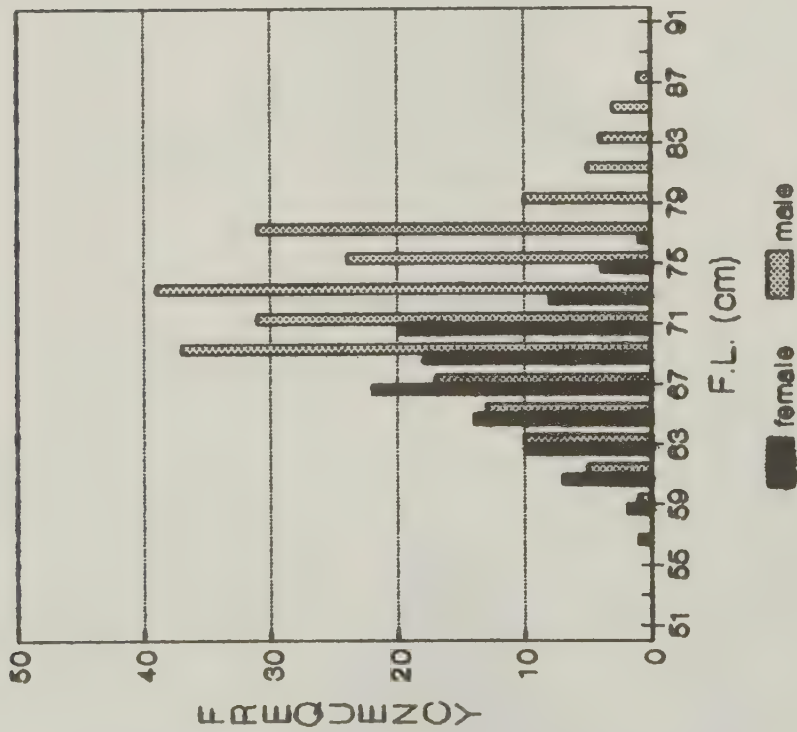


Fig.3 Length frequencies of male and female albacore.

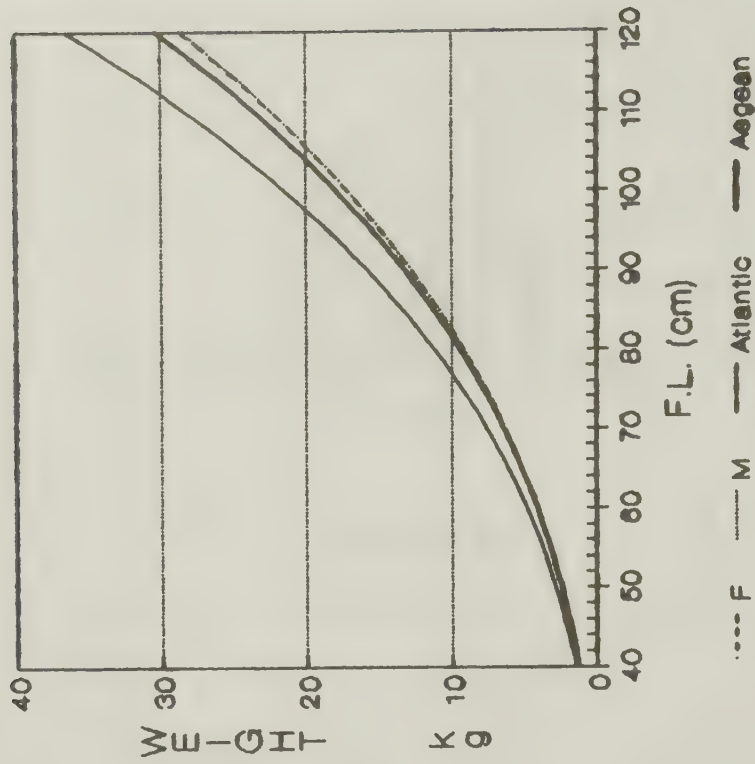


Fig.4 Comparison of length-weight relationships for males and females and for Aegean and Atlantic albacore

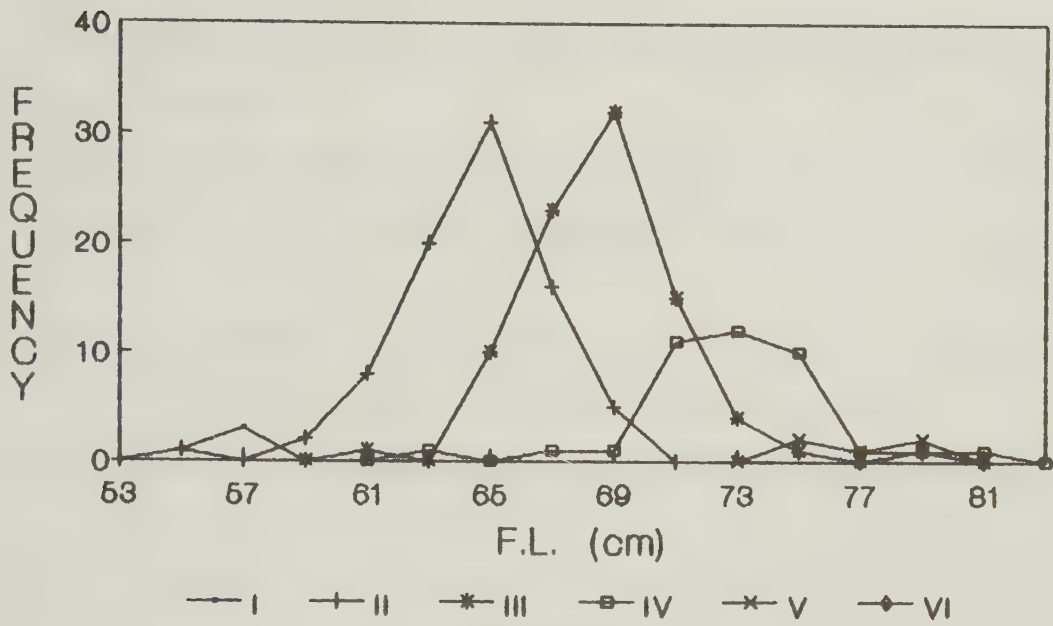


Fig.5 Length frequencies of albacore by estimated age groups

FIRST RESULTS ON THE AGING OF JUVENILE SWORDFISH,
XIPHIAS GLADIUS L., FROM THE MEDITERRANEAN SEA, USING OTOLITHS

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ABSTRACT

Age estimates were made on juvenile swordfish, Xiphias gladius L., from the Mediterranean Sea using otoliths. Increments were observed in a transverse plane of sectioned sagittae with light and scanning electron microscopy. Counts of these increments were made for age estimation. Estimated ages ranged from 87 to 147 days for fish ranging in size from 51 to 74 cm. A growth rate of 2.3 mm/d within the size interval analyzed was calculated.

INTRODUCTION

The swordfish, Xiphias gladius L., occurs widely in the Mediterranean Sea and supports important commercial fisheries. However, a lack of biological data, particularly on age and growth rates, does not permit a definitive assessment of the status of the resource.

Attempts at age estimation of swordfish from the Mediterranean have been made using size frequency analysis (De Metrio and Megalofonou, 1987) and anal fin spine sections (Megalofonou and De Metrio, 1989), but age determination of swordfish is still in its developmental stages.

The objective of this study was to estimate the age and the growth of young swordfish from information contained in otoliths.

MATERIALS AND METHODS

A total of 26 small swordfish were collected during commercial albacore operations in the Gulf of Taranto in the autumn of 1987. Eviscerated weight in Kg, lower jaw fork length (LJFL) in cm and date of capture were recorded for each fish.

Otoliths were removed, cleaned, dried and embedded in epoxy resin (Spurr, 1969). The embedded sagittae were ground in a transverse plane through the core region on 220, 400 and 600 grit wet-dry emery paper and polished against a piece of Microcloth containing 0.3 micron alumina polishing compound.

Sections were examined at 600 to 1500x with an Olympus BH2 compound microscope adapted for video viewing. Continuous increment counts from the core to the margin of the antistrostrum were made from the video monitor. Otolith readings were performed by two independent readers and the precision of the counts was assessed (Beamish and Fournier, 1981). Four sections were also examined with scanning electron microscopy for which they were decalcified with 5% EDTA, (pH 7.6) and coated with gold.

Counts of presumed growth increments were used to estimate the age and growth. An average percent error of 2.1% was calculated

for the two repetitive series of determinations and with that information, the average age was calculated for each fish. Artificial fertilization and hatching of the Mediterranean swordfish (Yasuda et al., 1978) showed that the eggs hatched from 60 to 70 hours after fertilization at water temperatures ranging from 22.5 to 23.6 C. This information was used to estimate the age after fertilization and the increment counts were adjusted by adding a factor of 3 days to the increment count.

RESULTS

Swordfish length (LJFL) ranged from 51 to 74 cm while weight was from 0.51 to 2.78 kg.

The presumed daily growth increments were clearly and easily distinguished along a counting path from the core to the edge of the antirostrum and variability in their width was clearly observable (Figure 1). There was a zone of about 10 increments which began outside the core with an average width of 4.8 micron. That zone was followed by another area of about fifty wider increments with an average thickness of 5.6 micron. Beyond this point increment widths averaged 4.6 micron and continued to the tip of the antirostrum. This indicates differential otolith growth during presumed different developmental periods.

Estimated ages ranged from 87 to 147 days. The average growth rates for all the period of life of each individual, calculated from length at estimated age, ranged between 4.6 and 6.7 mm per day with an average value of 5.7 mm per day.

The regression analysis of age against LJFL ($r=0.71$, $a=35.8$, $b=0.23$) and weight ($r=0.80$, $a=2.0$, $b=0.03$) gave the best correlation coefficients for the linear model. The slope of 0.23

indicates a growth rate of 2.3 mm/d within the size interval analyzed (Figure 2).

Estimated spawning dates were from June 27 to August 25. Most of the specimens (85.7%) were spawned in July and especially during the first fifteen days of the month (Figure 3).

DISCUSSION

In recent years, otolith microstructure examination has found an increasing number of applications in a wide range of species (Campana and Neilsen, 1985). Otolith microstructure studies, mainly of the larval and juvenile stages, have confirmed that daily increments can be used to successfully estimate age and growth rates of fishes (Rice et al., 1985; Secor et al., 1989).

In our observations of the sagitta sections, both under the light microscope and with the SEM, we clearly recognized fine increments like those Wilson and Dean (1983) described on Atlantic swordfish otoliths. They were similar to daily increments described for other species (Tanaka et al., 1981; Dean et al., 1983; Campana and Neilsen, 1985) and we hypothesize that swordfish post-larvae and juvenile otoliths have all the microstructural characteristics that correspond to daily increment growth features. Therefore, we used the increment counts to estimate the age and the growth rates for the individual fish.

We do not have direct validation of the growth increments for this study, so we attempted to verify them with indirect methods. Two lines of evidence are used to compare our results with other available data on the early life history of swordfish.

Estimated spawning dates from our analysis occurred during the

months of June, July and August. Most of the estimated spawning dates were in July and were concentrated in the first 15 days of the month (Figure 3). These results are in complete agreement with examinations of the maturity stages of swordfish gonads collected from commercial fishery during the year (Megalofonou et al., 1987) and the seasonal appearance of swordfish larvae in the Mediterranean. Spawning generally takes place from June through August with the peak in early July (Selia, 1911; Sanzo, 1922; Cavaliere, 1963; De Metrio et al., 1988).

Another method we used to verify the estimated juvenile ages was to compare this data with those estimated by length frequency analysis from the same population. Modal analysis suggested that the swordfish between 55 and 65 cm captured in the Gulf of Taranto during autumn are less than one year old (60-90 days) (De Metrio and Megalofonou, 1987). Our results indicate that the juvenile swordfish captured during the autumn (October and a few in December) in the Gulf of Taranto, ranging in size from 51 to 74 cm, are juvenile individuals of a few months with estimated ages of from 87 to 147 days.

Average growth rates estimated indicate that swordfish have a rapid growth during their early life history. However, the whole pattern of growth in larval and juvenile stages is not clear. The regression analysis for swordfish within the size interval 51-74 cm showed that growth in this range was linear with a slope of 0.23 corresponding to a growth rate of 2.3 mm per day. We have not yet examined samples of smaller or larger swordfish from the Mediterranean. The information available on swordfish growth rates during their larval, post larval and juvenile stages is very limited. De Metrio and Megalofonou (1987) indicated that the average size of one year old swordfish is about 97.5 cm with an

average growth rate of 2.7 mm/d.

The results of this study indicate that growth increments can be used to estimate the age of young swordfish and help clarify some aspects of juvenile swordfish growth. It is not yet possible to draw definitive conclusions about the whole pattern of growth in larval and juvenile stages. However, we believe that further studies on otoliths, from both smaller and larger individuals, can provide the information necessary to form a better understanding of the growth of larval and juvenile swordfish.

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Fig. 1. Growth increments near to the core observed with light microscopy (1000x).

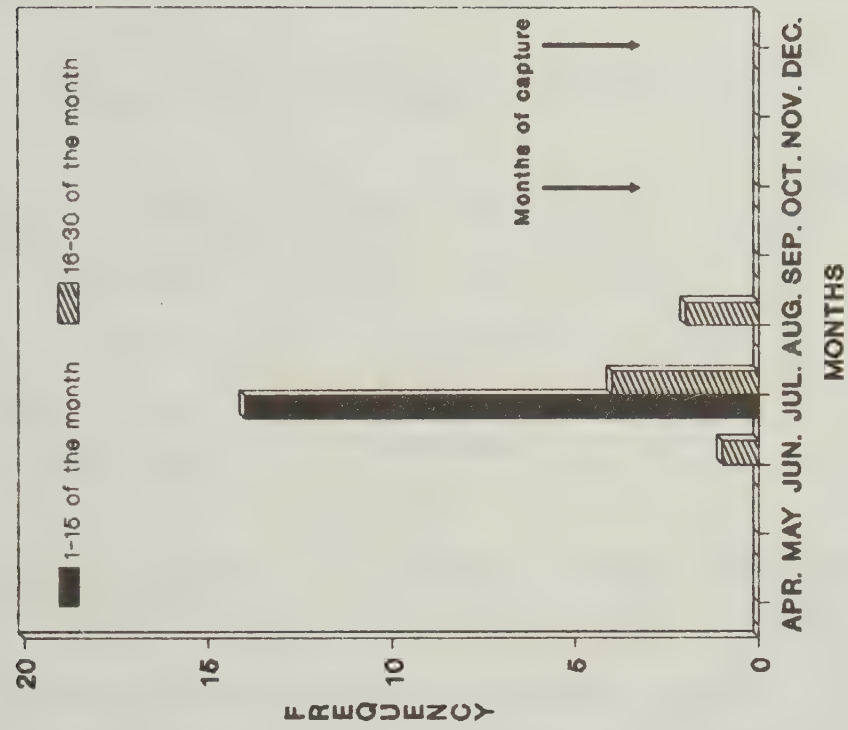


Fig.3 Estimated spawning dates

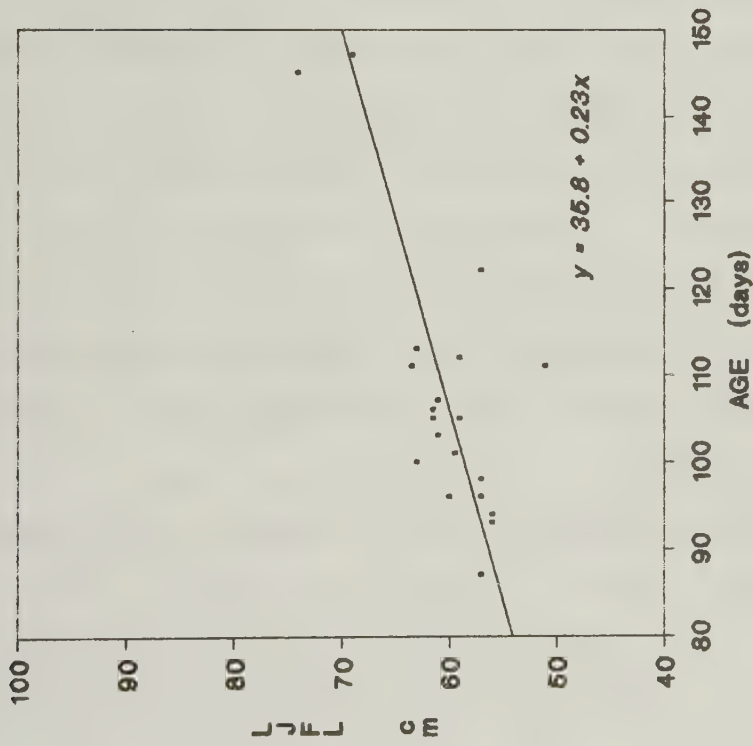


Fig.2 Age-length relationship

CATCH, SIZE DISTRIBUTION, AGE AND SOME POPULATION PARAMETERS OF
SWORDFISH, XIPHIAS GLADIUS L., IN THE GREEK SEAS.

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ABSTRACT

Greek swordfish, Xiphias gladius L., landings are estimated at 1530 MT in 1986 and 1179 MT in 1987. The bulk of the catches is made up of young specimens. The catch-at-length and the catch-at-age indicate that most of the individuals were up to three years of age and belonged to the length classes between 46 and 143 cm. Estimates of age were made from counts of growth bands on anal spine sections. The estimated von Bertalanffy growth parameters were:

for males	$L_{\infty}=203.2$; $k=0.21$; $t_0=-2.0$
for females	$L_{\infty}=236.5$; $k=0.17$; $t_0=-2.1$
for both sexes	$L_{\infty}=243.8$; $k=0.14$; $t_0=-2.6$.

Theoretical growth in weight was obtained by converting length to weight. Females grow faster after the second year of age and reach a larger size than males.

Total mortality rates computed by two methods were higher in 1986 ($Z=0.464$ and $Z=0.443$, 1986; $Z=0.309$ and $Z=0.305$, 1987).

INTRODUCTION

In the years 1986 and 1987 a survey was carried out in the Greek seas on the fishery of large pelagic species (Xiphias gladius L.,

Thunnus thynnus L., Thunnus alalunga Bonn.), financed by the European Community Commission with the basic aim of obtaining an estimate of the fishery in Greece in terms of total production and of C.P.U.E. (De Metrio et.al., 1988).

In the present work swordfish data and biological material collected on that occasion, at the various fishing ports, are used. The aim is to provide information on the catch, size distribution, growth and mortality of swordfish exploited in the Greek Seas which could be useful for a future stock assessment of this species in the Mediterranean Sea.

MATERIALS AND METHODS

Data on the number of swordfish fishing fleets, on the number of boats in each fleet and of the total catch of each boat was collected, by means of inspections, interviews and direct surveys for the whole of Greece, in 1986 and 1987.

In two pilot ports(Kalimnos in Dodecanese and Chania on the island of Crete) in 1986 and in three (Kalimnos, Chania and Kithnos in the Cyclades Islands) in 1987, permanent observers collected additional data on: number of fishing days, number of hooks, number and weight of fish caught per day. Measurements of lower jaw fork length (LJFL) and the weight (free of all abdominal organs, fins and sword) were taken. Anal fins were collected from 270 swordfish of which the LJFL, the weight, the sex and the date of capture were recorded.

Using the data collected, the total swordfish catch in weight and in number of fish for the whole of Greece was calculated, both for 1986 and 1987.

As it was seen that the length frequencies of the catch of the

various fleets showed differences due to the dimensions of the boats and the fishing areas in which they operated, it was decided to group all the Greek fleets by area and assimilate the catch of each area to that of the pilot port.

Therefore in the first year of research Greece was divided into two large areas: Dodecanese, in which size samples from Kalimnos were used to size the catches and the rest of Greece (Ionian Islands, Crete, Peloponnese etc.), in which the size samples from Chania were used to size the catches.

In the second year of the research, a more accurate analysis of the Greek fishing situation and of the length frequencies, suggested the necessity to establish a third pilot port in the Cyclades Islands. For this the port of Kithnos was chosen. The size samples of Kithnos were used to size the catch of the Cyclades Islands.

Raising the monthly size frequency samples to the corresponding catch in number of fish, it was possible to calculate the catch-at-length per month and per whole fishing season for each pilot port and area. The raising factors were estimated by dividing the catch in number by the total number of fish in the size frequencies used. Grouping the results of the individual areas it was possible to estimate the catch-at-length for Greece. The frequencies were calculated in number of swordfish by 5 cm intervals of LJFL.

The age of the swordfish was estimated (MEGALOFONOU and DEMETRIO, 1989) using sections of the spines of the anal fins. The relationship between lower jaw fork length and spine radius was determined with regression analysis. Back calculations of the length at estimated age was obtained using the equation (TESCH, 1971; RICHER, 1975):

$$L_n - c = (S_n/S) \cdot (L - c)$$

where L = LJFL at the time of capture

L_n = LJFL when band n was formed

c = a correction factor (intercept on length axis from regression of length on spine radius)

S_n = distance from spine focus to the edge of band n

S = radius of the spine.

Mean back-calculated lengths at estimated ages were calculated. Estimates of theoretical growth in length were obtained by fitting the mean back-calculated lengths at estimated ages to the von Bertalanffy growth equation (SPARRE, 1987). Theoretical growth in weight was obtained by converting length to weight using the length-weight relationships established in the present work and that of De Metrio and Megalofonou (1987).

The catch-at-age was calculated from the total swordfish catch-at-size (in number of fish by 2 cm intervals of LJFL) using the mean lengths at ages from the growth equation developed for the two sexes together. Lower and upper limits of LJFL at each age were established and used to assign fish to an age class.

Two methods were taken into consideration for the calculation of total mortality rates (Z): 1) length converted catch curve analysis 2) Beverton and Holt equation (SPARRE, 1987).

RESULTS

A - Total Catch and Length Distribution

In 1986 the total swordfish catch in Greece was estimated at 1530 tons of which 712 tons were caught in the Dodecanese area (pilot port Kalimnos) and 818 tons in the rest of Greece (pilot port Chania).

At Kalimnos 4343 individual fish were weighed out of 8805 caught, and their average weight was 32.6 kg.

At Chania 756 individuals were weighed out of 996 caught and their average weight was found to be 23.1 kg.

Assimilating the catch of the two areas with that of the respective pilot ports, the following results were obtained,

Dodecanese : 712 MT / 32.6 kg = 21840 individuals

Rest of Greece : 818 MT / 23.1 kg = 35411 individuals

Therefore, in 1986, the total number of individual fish caught was presumably 57251.

In 1987 the total estimated catch was 1179 tons, of which 540 were caught in Dodecanese, 35 tons in the area of the Cyclades Islands (pilot port Kithnos) and 604 in the rest of Greece.

The individuals weighed in the pilot ports were:

Kalimnos: 6209 individuals (100% of the catch) with an average weight of 35.1 kgs;

Chania : 998 individuals (100% of the catch) with an average weight of 18 kgs;

Kithnos : 361 individuals, out of 451 caught, with an average weight of 10.8 kgs

The catch of the different areas was assimilated with that of the pilot ports and it was found that:

Dodecanese : 540 MT / 35.1 kg = 15384 individuals

Cyclades Islands: 35 MT / 10.8 kg = 3241 individuals

Rest of Greece : 604 MT / 18.0 kg = 33553 individuals

from which it can be deduced that the total number of individuals caught in 1987 was probably 52178.

The distribution of the total swordfish catch in Greece, according to length, is shown in Table I for 1986 and in Table II for 1987. The percentage frequencies are shown respectively in Figure 1 and Figure 2.

B - Length-Weight Relationships, Age and Growth

Swordfish length (LJFL) ranged from 71.5 to 207 cm while weight was from 3 to 104 kg. Of the 241 specimens which were used in the analysis 129 were males and 108 were females. The length-weight relationships (Figure 3) are found to be:

$$\begin{array}{llll} & -6 & 3.07 & \\ \text{for males} & W = 7.416 \times 10 & \times \text{LJFL} & (r=0.97) \\ & -6 & 3.19 & \\ \text{for females} & W = 3.968 \times 10 & \times \text{LJFL} & (r=0.98) \\ & -6 & 3.14 & \\ \text{for both} & W = 5.371 \times 10 & \times \text{LJFL} & (r=0.97) \end{array}$$

The regression analysis carried out between the radius of the spine and the LJFL showed a significant linear correlation for both sexes:

$$\begin{array}{lll} \text{males} & \text{LJFL} = 70.0 + 19.69 \times S & (r=0.91) \\ \text{females} & \text{LJFL} = 71.1 + 19.20 \times S & (r=0.93) \end{array}$$

As no significant difference was observed between the two sexes, the relationship was calculated together for males and females (figure 4):

$$\text{LJFL} = 71.07 + 19.22 \times S \quad (r=0.92)$$

which was used for the back calculation analysis.

Age estimates ranged from 0+ to 9+ years. The oldest fish found was a nine year old female with a LJFL of 207 cms; the oldest male was 8 years old. The relationship between the estimated age and the LJFL is shown in figure 5. Mean back calculated lengths at estimated ages and the lengths at age predicted by the model of von Bertalanffy, are shown in Table III while the von Bertalanffy

growth parameters and the confidence limits are illustrated in Table IV. Von Bertalanffy's equations for the theoretical growth in length are:

$$\text{for the male } Lt = 203.23 [1 - \exp (- 0.21) (t+2.04)]$$

$$\text{for the female } Lt = 236.49 [1 - \exp (- 0.17) (t+2.10)]$$

$$\text{both } Lt = 243.77 [1 - \exp (- 0.14) (t+2.60)]$$

Theoretical growth in weight (Table V), was obtained by converting LJFL to weight using the equations established from the regression analysis. Von Bertalanffy's equations are:

3.07

$$\text{for the male } Wt = 90.4 [1 - \exp (- 0.21) (t+2.04)]$$

3.19

$$\text{for the female } Wt = 153.0 [1 - \exp (- 0.17) (t+2.10)]$$

3.14

$$\text{both } Wt = 168.0 [1 - \exp (- 0.14) (t+2.60)]$$

Theoretical growth in weight for the two sexes together was also obtained using the equation of De Metrio and Megalofonou (1987) (Table V). Estimated W_{oo} values are: 112 kg for males, 180.8 kg for females and 199 kg for the sexes combined.

C - Catch-at-age

Because sex ratio samples were only available for one area, the growth curve obtained from the sexes combined was selected as the most appropriate for the purpose of aging the catch at size (Table VI). Most of the swordfish catch consists of young individuals for both 1986 and 1987. About 50% of the landing comprises fish one and two years old.

D - Mortality

The estimates of total mortality rates (Z) carried out according to the Beverton and Holt equation are:

1986: $Z = 0.464$ $l' = 132.5$ cms $l = 156.7$ cms

1987: $Z = 0.309$ $l' = 97.5$ cms $l = 141.8$ cms

where l' = length of smallest fish fully represented in the sample
and l = average length of all fish above l' .

Calculation of the mortality rates through the analysis of length-converted catch curves in 1986 showed

$Z = 0.443$; st.dev. 0.042; confidence limits from 0.352 to 0.534.

The first length class used for the analysis was that with LJFL between 130 and 135 cm while the last one was between 205 and 210 cm; $r = -0.94$.

In 1987 $Z = 0.305$ was found with a standard deviation of 0.301 and confidence limits from 0.239 to 0.370.

First class used: 95 - 100 cms; last class: 205 - 210 cms; $r = -0.90$.

The length-converted catch curves for 1986 and 1987 are shown in Figures 6 and 7 respectively.

CONCLUSIONS

Although swordfish fishery is a relatively recent activity in Greece, it has evolved rapidly in the brief period of twenty years and still shows a tendency to expand. Today, with an annual production of about 1.500 tons, Greece has established itself

decisively as the second most important country in the Mediterranean for swordfish fishery (DE METRIO et al.,1988).

The characteristics of the catch reveals that, also in this country, the majority of fish caught are from the first age groups, with groups 1 and 2 being the most frequent. This situation now seems a general characteristic in all parts of the Mediterranean. In fact, the sizes, found in both years, do not seem different from those reported, for the same period, by us and other authors for the Central and Western Mediterranean (DE METRIO and MEGALOFONOU,1987; DE METRIO et al.,1988; MARANO et al.,1987; REY et al.,1987).

The results of the age estimates suggest a maximum lifespan of at least 8 years for males and of at least 9 years for females. Therefore the swordfish can be considered a large moderately longlife pelagic fish. However, the maximum lifespan of the species in this area could be higher in that individuals were caught which are larger than those examined for this work. In fact, the largest individual caught in the Aegean in the years 1986-87 had an LJFL of 221 cms, while the largest individual caught in the Gulf of Taranto in the four years 1985-88 had an LJFL of 230 cms.

Estimates of population parameters indicated that females reach a larger asymptotic size than males. Considering the fact that also in areas like the Atlantic, where the greatest dimensions for the swordfish have been recorded, few males exceed an LJFL of 200 cms (BECKETT,1974), the estimate of a Loo of 203.4 cms for males seems acceptable. In fact among all the males examined in the Aegean during the two years considered, none exceeded 200 cms. The estimate of a Loo of 236.5 also seems acceptable for the female considering the maximum dimensions of the animals recorded in the Aegean and in the Ionian Sea (DE METRIO et al.,1986, 1988; DE METRIO and MEGALOFONOU, 1987) in the Adriatic (MARANO et al.,1987)

and other areas of the Western Mediterranean (REY et al.,1987). Anyway this is much smaller than those found in the Atlantic (Loo = 340 cm BERKELEY and HOUDE,1983; Loo = 266.7 cm RADTKE and HURLEY,1983). A lack of large females in the sample from the Mediterranean may have had an effect on the resulting von Bertalanffy parameter of Loo.

The growth rate in the two sexes appears different as had already been shown in previous studies (GUITART-MANDAY,1964; BECKETT,1974; BERKELEY and HOUDE, 1983; WILSON and DEAN,1983; RADTKE and HURLEY,1983). It seems that the females, after the second year of life, grow more quickly than the males. In any case the differences in the growth rates found in this work are less than those observed in the Atlantic by other authors (Table VII). The results reported here are much closer to those of BERKELEY and HOUDE (1983) than they are to those of WILSON and DEAN (1983) and to those of RADTKE and HURLEY (1983).

The differences observed previously, relative to the values of Loo and to k, although they cannot be completely explained, can however be related to various factors: different techniques used, different dimension range of the sample, the existence of different populations, different environmental conditions.

Results of the length frequency modal analysis (DE METRIO and MEGALOFONOU,1987) have been used to examine the validity of age estimates made on swordfish using anal spine sections. It was observed that length at ages one and two derived from spine sections agreed well with the results of length frequency modal analysis. In fact, modal analysis suggested that the swordfish with a length (LJFL) between 95 and 100 cm captured during July are one year old and those with a length between 120 and 125 cm are two years old. Our results indicated that swordfish of one year old are

97 cm in LJFL as regards males and 98.3 cm as regards females while swordfish of two years old are 117.4 and 120.4 respectively. It is obvious, that length frequency modal analysis validate the method for the first age groups but cannot be used for the older age groups. Considering that most of the catch consists of young individuals, the validity of the two first groups is very important, especially for the purpose of aging the catch at size. However a complete validation of the method is necessary. Examination of the hard parts of the swordfish marked and treated with tetracycline could be a good solution in the future for the validation problems.

As the complex rearrangement of the data does not permit the drawing of definite conclusions on the mortality of swordfish in the Mediterranean, it does however seem that the different values of the mortality rates found in the two years studied, could be attributed to the fact that recruiting is widely represented in the catch and its contribution is quantitatively subject to annual variations dependent on the success of the reproductive process and the survival of the larvae and juveniles. Initially a doubt had emerged that the difference could be due to the incidence, in 1987, of catch by the Kithnos fleet. For this reason the mortality rate for that year was recalculated excluding the Kithnos catch. The difference between the two calculations was not significant (0.305 with Kithnos; 0.295 without Kithnos).

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Table I - Swordfish catch-at-length. Greece 1986.

LJFL	1 - 6	7	8	9	10	11	12	Total
45		0	0	165	0	0	0	234
50		0	0	82	987	0	0	1405
55		0	0	91	63	0	0	240
60		181	0	9	501	0	0	1168
65		0	0	0	147	0	0	298
70		121	0	0	273	0	0	694
75		181	312	0	42	0	0	740
80		228	312	82	42	0	0	931
85		501	156	82	0	0	0	1051
90		726	346	197	164	0	0	1994
95		894	881	228	0	0	0	2851
100		865	1294	296	0	0	0	3583
105		634	536	260	21	0	0	2076
110		918	993	324	42	0	0	3548
115		1406	546	200	42	0	0	3474
120	N O	1662	1082	273	42	0	0	4723
125		1720	1405	163	0	0	0	5076
130	D A T A	1143	714	283	0	0	0	3392
135		747	948	160	0	0	0	2784
140		354	703	86	168	0	0	2185
145		579	480	36	63	0	0	1844
150		582	948	50	84	0	0	2556
155		275	346	18	42	0	0	1038
160		535	167	82	21	0	0	1366
165		640	413	23	21	0	0	1643
170		373	759	27	21	0	0	1864
175		427	346	32	0	0	0	1183
180		529	257	18	0	0	0	1178
185		199	190	9	0	0	0	620
190		199	312	14	0	0	0	751
195		32	0	5	0	0	0	72
200		215	0	14	0	0	0	359
205		60	156	9	0	0	0	298
210		0	0	0	0	0	0	0
215		16	0	0	0	0	0	32
220		0	0	0	0	0	0	0
	19600	16942	14602	3318	2786	0	0	57251

Table 11 - Swordfish catch-at-length. Greece 1987.

LJFL	1 - 2	3*	4*	5	6	7	8	9**	10-12	Total
45		0	0	0	0	0	0	0	0	0
50		0	0	0	0	0	0	0	0	0
55		168	0	0	45	0	0	0	0	228
60		101	0	0	45	0	19	0	0	179
65		0	235	9	223	0	0	0	0	503
70		0	101	280	113	392	42	0	0	1013
75		34	403	254	222	406	127	0	0	1615
80		0	101	156	311	428	932	146	0	2276
85		0	24	94	170	850	1059	0	0	2437
90		0	34	110	81	1833	1407	146	0	4000
95		34	0	0	0	922	1049	365	0	2576
100		34	0	76	12	379	1191	959	0	2889
105		34	34	46	31	195	508	468	0	1424
110		34	101	247	227	332	376	473	0	1947
115		0	34	338	194	302	166	142	0	1341
120	N O	0	0	396	311	497	431	215	0	2040
125		34	0	271	355	335	696	177	0	2041
130	D A T A	0	0	328	341	394	549	508	0	2404
135		0	0	494	626	680	1055	250	0	3448
140		0	0	319	204	549	638	484	0	2428
145		0	0	389	148	267	384	177	0	1550
150		0	0	354	192	489	347	755	0	2345
155		0	0	155	322	542	703	230	0	2167
160		0	0	329	203	885	406	474	0	2534
165		0	0	243	237	239	382	288	0	1556
170		0	0	158	218	233	229	302	0	1258
175		0	0	365	166	506	304	264	0	1786
180		0	0	195	255	230	187	317	0	1311
185		0	0	265	200	312	102	88	0	1080
190		0	0	97	37	63	132	93	0	473
195		0	0	124	0	138	57	88	0	452
200		0	0	103	55	52	42	146	0	443
205		0	0	82	74	13	85	0	0	284
210		0	0	24	0	0	42	0	0	75
215		0	0	0	0	56	0	0	0	62
220		0	0	12	0	0	0	0	0	14
	- -	473	1067	6313	5618	12519	13647	7555	0	52179

* - The catch of Kalimnos is not included

** - The catch of Kithnos is not included

TABLE III - Mean back-calculated lengths at age and predicted by the von Bertalanffy model for swordfish

Age	LJFL Back calculated			LJFL von Bertalanffy		
	Males	Females	Both	Males	Females	Both
1	96.4	97.8	97.0	97.0	98.3	99.0
2	117.9	120.2	118.9	117.4	120.4	118.3
3	134.7	140.1	137.4	133.9	138.8	135.0
4	148.0	155.0	151.7	147.3	154.3	149.5
5	158.2	167.8	163.3	158.0	167.3	162.0
6	165.0	174.9	170.1	166.7	178.3	172.9
7	171.6	188.6	177.2	173.8	187.6	182.3
8	182.0	195.1	188.6	179.4	195.4	190.5
9	-	202.8	202.8	-	202.0	197.6

TABLE IV - Estimates of growth parameters, standard deviation and confidence limits derived from the von Bertalanffy growth equation

		Estimate	std.dev.	confidence limits
Males	Loo	203.23	6.53	186.44 - 220.02
	k	0.21	0.02	0.15 - 0.28
	to	-2.04	0.28	-2.75 - -1.32
Females	Loo	236.49	6.72	220.00 - 252.97
	k	0.17	0.01	0.13 - 0.21
	to	-2.10	0.21	-2.62 - -1.58
Both	Loo	243.77	21.50	191.09 - 296.44
	k	0.14	0.03	0.05 - 0.23
	to	-2.60	0.61	-4.15 - -1.14

Table V. Estimated weights at age. * Weights calculated from the equation of De Metrio and Megalofonou (1987)

Age	Eviscerated weight (kg)			
	Males	Females	Both Sexes	
1	9.3	9.3	9.9	11.5 *
2	16.8	17.6	17.3	20.3
3	25.1	27.6	26.3	30.7
4	33.6	38.7	36.2	42.4
5	41.7	50.2	46.6	54.7
6	49.2	61.5	57.1	67.2
7	55.9	72.3	67.4	79.4
8	61.6	82.3	77.4	91.3
9		91.5	86.9	102.5

TABELLA VI Swordfish catch-at-age in the Greek Seas. Age 9+ refers to fish that were 9 or more years old

Age	1986		1987	
	No	%	No	%
1	17197	30.0%	19142	36.7%
2	15658	27.3%	6370	12.2%
3	9034	15.8%	8559	16.4%
4	5475	9.6%	5261	10.1%
5	3258	5.7%	5139	9.9%
6	3039	5.3%	2993	5.7%
7	1996	3.5%	2514	4.8%
8	835	1.5%	944	1.8%
9 +	759	1.3%	1255	2.4%
TOTALE	57.251	100%	52.177	100%

TABLEA VII - Length at age estimates of swordfish from different studies. M=male, F=female.

Age	Berkeley and Houde, 1983		Wilson and Dean, 1983		Radke and Hurley, 1983		Megalofonou and De Metrio	
	M	F	M	F	M	F	M	F
1	97.2	98.0	116.9	122.9	84	73	97.0	98.3
2	118.5	119.9	123.3	130.6	98	85	117.4	120.4
3	136.0	139.7	130.2	138.8	110	114	133.9	138.8
4	150.4	157.8	137.4	147.5	122	131	147.3	154.3
5	162.3	174.3	145.0	156.8	133	147	158.0	167.3
6	172.0	189.3	153.0	166.6	143	160	166.7	178.3
7	180.0	202.9	161.5	177.1	153	172	173.8	187.6
8	186.6	215.3	170.4	188.2	161	183	179.4	195.4

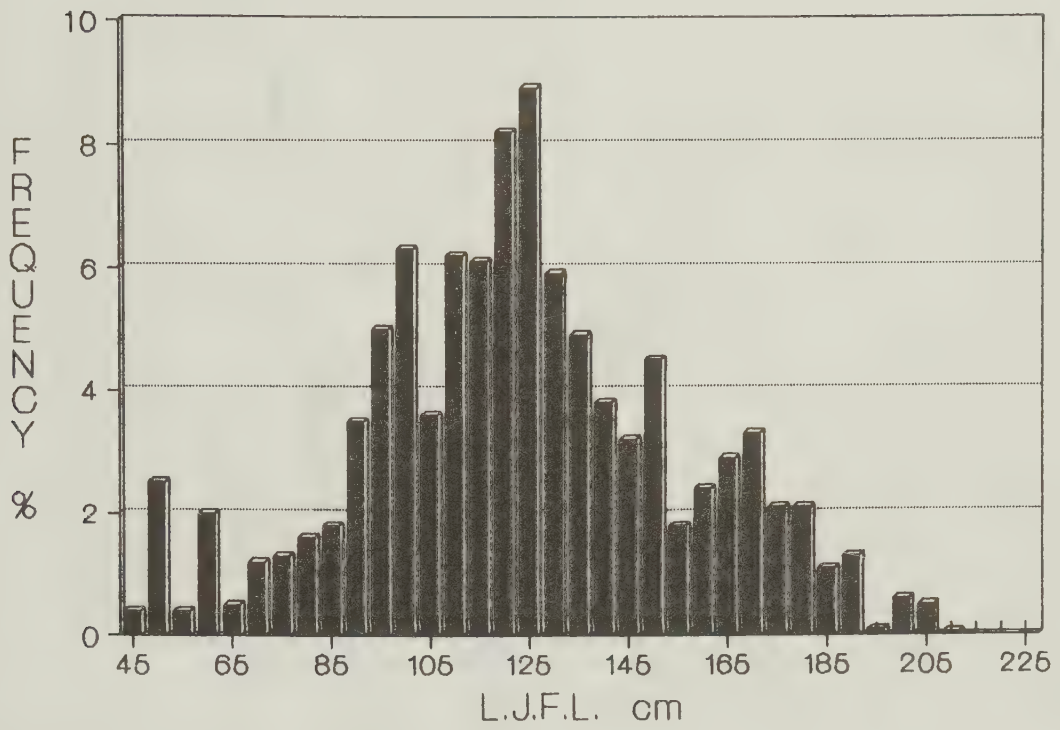


Fig.1 Length frequency distribution 1986

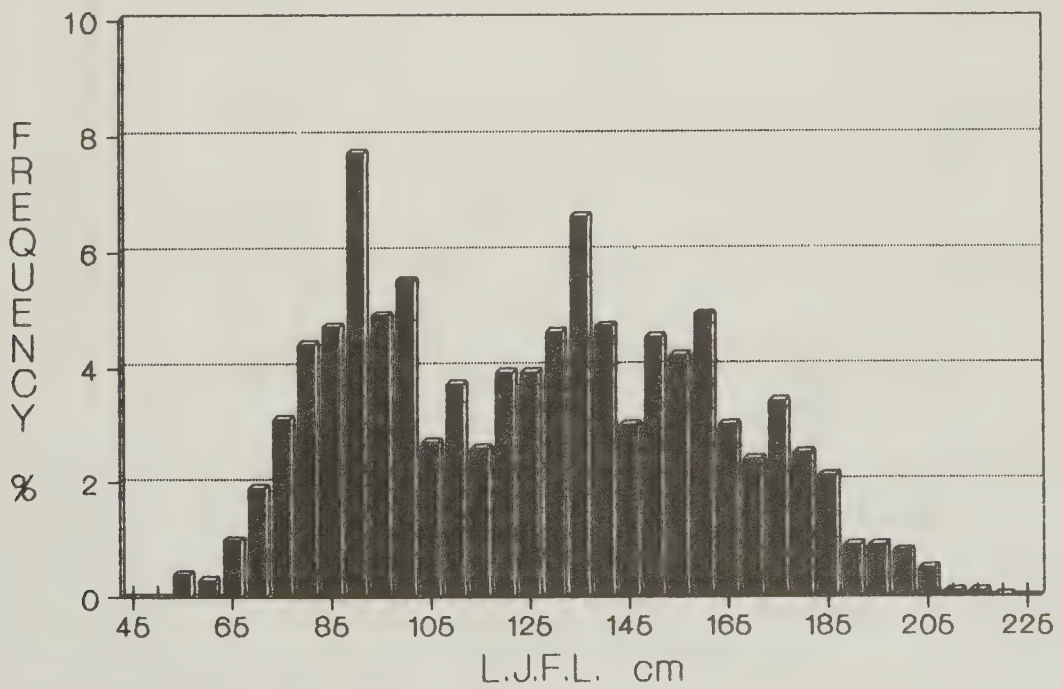


Fig.2 Length frequency distribution 1987

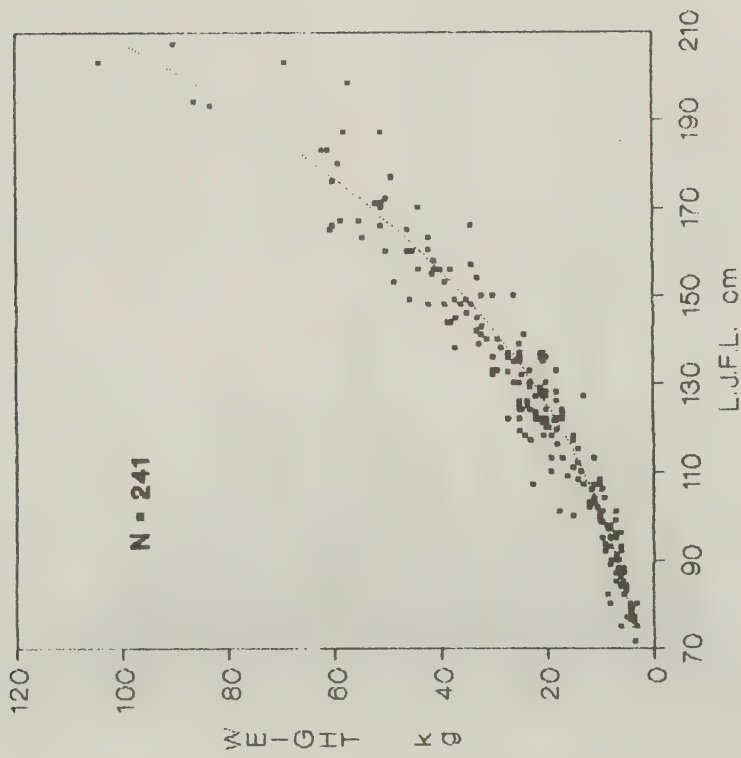


Fig. 3 Length-weight relationship for the sexes combined

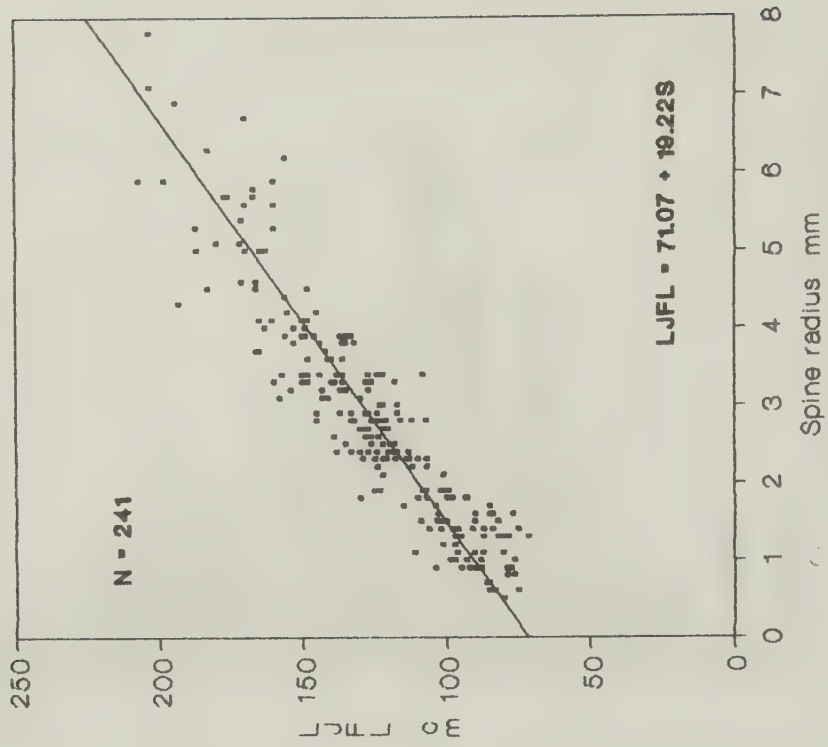


Fig. 4 Spine radius-length relationship for the sexes combined

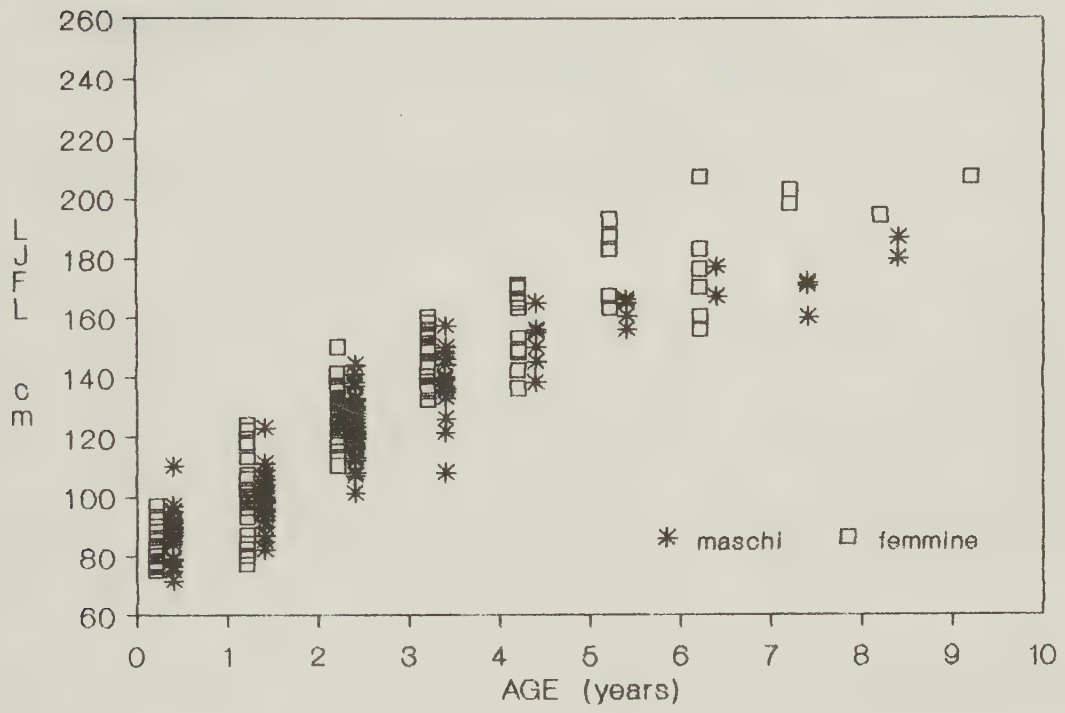


Fig.5 Lengths at estimated age

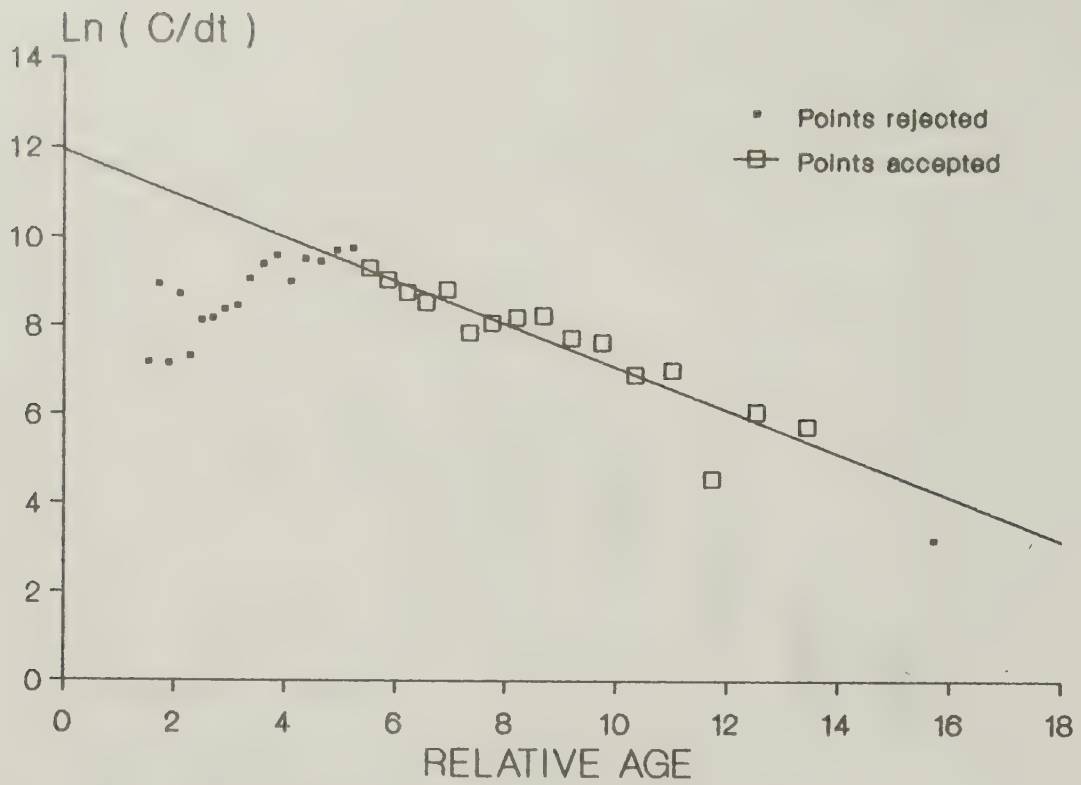


Fig.6 Length converted catch curve 1986

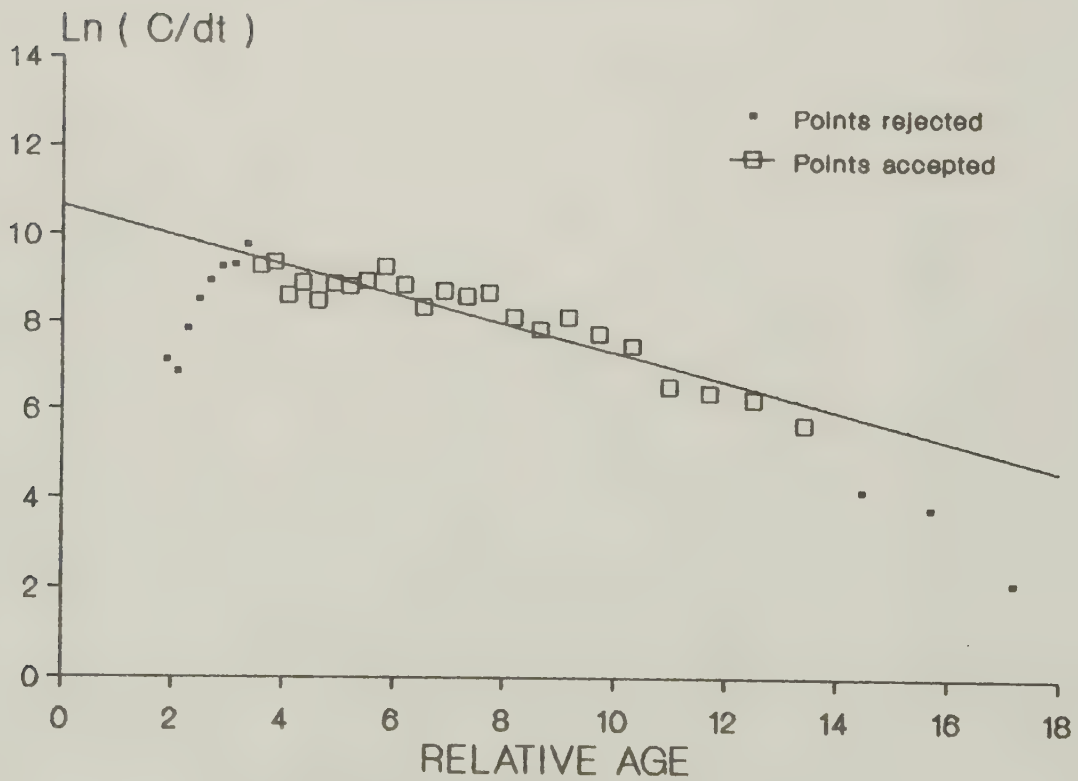


Fig.7 Length converted catch curve 1987

General description of Japanese longline fishery in the Mediterranean and some information on the size of bluefin imported into Japan from the Mediterranean countries.

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1. GENERAL DESCRIPTION OF LONGLINE FISHERY.

1.1 History of its fishery

There has been only one Japanese fishery operating in the Mediterranean Sea, that is longlining. In 1956, the Japanese longline fishery initiated its operations in the Atlantic (Hayasi et al. 1970). Fishing was located in the equatorial waters off Brazil and targeted mainly on yellowfin. Since then, the fishery has widened its fishing area eastward and toward temperate waters in both hemispheres year after year. Target species have also changed from yellowfin and albacore to bigeye, southern bluefin and northern bluefin, in the course of development of the fishery.

The Japanese longliners first entered into the Mediterranean in 1972. There the catch was predominantly composed of bluefin tuna accompanied by a very minor amount of swordfish and albacore.

1.2 Catch trend

Figure 1 shows the annual Japanese catch in the eastern Atlantic and Mediterranean. During the early 1960s the catch was made in equatorial to subtropical waters in the eastern Atlantic, but it was not until 1974 that the catch became significant. It reached the highest level in 1974 in the Mediterranean (2,300 tons) and in 1975 in the eastern Atlantic (3,000 tons). Catches in both areas showed similar trends; i.e., high during 1974-77 and 1982-84, low during 1978-81. It differed, however, in recent years; i. e., the catch in the eastern Atlantic continued to increase, whereas it has been declining in the Mediterranean.

1.3 Description of the fishery

The longline operation is made in one set per day. The line setting starts in the early morning (approximately 4:00 am) and takes about 4-5 hours. The hauling starts at around noon and lasts more than 10 hours. Usually about 2500 hooks are used a day. The standard gear has the following characteristics: the number of branch lines between floats, 5-7; length of main line between neighbouring branch lines, 50 m; float line length, 25-30 m; branch line length, 20-30 m. As a bait, squid is most preferable for bluefin, though other fish such as mackerel, horse mackerel and saury are used as well.

The fishing season for bluefin in the eastern Atlantic starts in March in the waters (25°N - 40°N , 5°W - 20°W) off Morocco and mainland Portugal (Figures 2 and 3). It is thought that these longliners are aimed at bluefin entering the Mediterranean for spawning. The fleets move east through the strait of Gibraltar, and reach waters off Sicily and Tunisia in mid-May apparently following the migrating schools (Figure 3). During June and July, although sporadic catches were observed in the Mediterranean, the fishing season is nearing its end (as later mentioned, fishing is prohibited from May 21 to June 30). Fishermen avoid catching the post-spawners because of their low commercial value.

The size of fish caught by this fishery is shown in Figure 5. The Japanese longline fishery caught adult bluefin mostly over 150 cm in the eastern Atlantic and over 180 cm in the Mediterranean.

The longline boats now operating in the Mediterranean have 300-400 tons of carrying capacity and crews of about 20. Among the 400 or so boats of this size which are registered, 50 operate in the north-eastern Atlantic and in the Mediterranean as a rule. Pursuant to Japanese domestic regulations on fishing for the Mediterranean bluefin tuna, fishing in the Mediterranean between May 21 and June 30 has been prohibited since 1975; also, the number of boats licensed to operate in the Mediterranean has been limited to 35 since 1985, for the protection of the spawning adult in the same area.

2. SOME INFORMATION ON THE SIZE OF BLUEFIN IMPORTED INTO JAPAN FROM MEDITERRANEAN COUNTRIES.

Japan has been the largest bluefin-importing country in recent years. Bluefin tuna are flown and shipped to Japan from almost all the countries that catch this species.

The amount of bluefin imported from Mediterranean countries has increased markedly during the last 5 years, as shown in Table 1 (Anon.) and Figure 6. Imports of bluefin other than those from Mediterranean countries, and southern bluefin tuna, are also shown in Figure 6 to show the relative importance of imports from the Mediterranean countries. For 1989 and 1990, imports are shown on a monthly basis (Table 2). The main exporters are Spain, which has the largest share, Turkey, Greece, Morocco and Tunisia. It should be noted that the last two countries are new exporters of tuna, and so far the amount being flown from Tunisia to Japan this year is quite large.

Size data with some brief information on the fisheries were collected through the courtesy of Japanese traders. Dressed weights (i.e., headed, gilled, gutted and tailed) in kilograms were provided by traders at the domestic markets in Japan. Data are available by country and gear, although countries and gears are mixed in some cases.

These data may give us useful information on each fishery, in particular when we consider substitution between available data to construct the length or age composition of the catch. In some cases, it may be possible to utilize these data as an observed length-frequency sample. It should be kept in mind, however, that those fishes sent to Japan were selected for size and quality so that these length frequencies might not match the original ones. It appears that 50 % of the fish caught are exported to Japan, but this percentage may have declined in the current year.

Figure 6 shows dressed weight frequencies by month, gear and country. Spain and Morocco, and Turkey and Greece, respectively, were often combined together. Information on fisheries and size of fish are summarized as below.

Spain and Morocco : Fishing gears are trap, purse seine and hand line. Fish are exported throughout the year. From April to June fish are directly sent to Japan. On the other hand, those caught in July are cultivated in net pens for 3-6 months to improve meat quality which is supposed to be lost in the spawning; then they are sent to Japan. The size of fish caught by trap ranges widely from 25 kg to more than 300 kg. In the hand-line fishery, fish are smaller (30-150 kg) with modes less than 100 kg.

Turkey and Greece : Purse seining and possibly hand-lining are used to catch bluefin. The fishing area is located in the Sea of Marmara (Kizil Adalar Islands, about 20 miles south-east of Istanbul) and around Thasos Island in the Aegean Sea. Fish are exported to Japan almost all year round in recent years. The size of fish was between 100 and 400 kg in January 1987. Since then, it has become smaller, in the range 20-200 kg, with 2 modes, one at 25 kg and the other at 100 kg.

Tunisia : Purse seines and traps are used; purse seine account for most of the catch. Fish is exported during the first half of the year. The size is small to medium for the fish caught by purse seine; the weights range 20 to 125 kg, but the majority are in the 25-75 kg range. It is observed from the dressed weight frequency distribution that the fish become larger as the season progresses. It is inferred that fishing takes place while fishes are migrating from north to southeast along the Tunisian coast.

France : Not many data are available. The gear is exclusively purse seine. Fish are small with a mode at around 25 kg.

References

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Table 1. Annual imports of bluefin tuna from Mediterranean countries for 1982-1989.

(unit:MT)

Year	FRANCE		SPAIN		GREECE		TURKEY		MOROCCO		TUNISIA		PORTUGAL		ITALY		Total
	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	
1982	-	-	6.2	36.9	-	-	-	-	-	-	-	-	-	-	1.5	40.6	85.2
1983	3.3	-	-	228.7	-	-	-	142.2	-	-	-	-	-	-	252.7	626.9	626.9
1984	-	16.7	53.8	97.2	-	-	0.7	126.4	-	-	-	-	-	-	0.9	295.7	295.7
1985	-	167.3	145.1	53.9	5.8	-	98.7	-	-	-	-	-	-	-	25.6	496.4	496.4
1986	0.8	-	104.2	49.8	70.9	0.9	668.9	-	-	-	-	-	0.3	-	24.6	920.4	920.4
1987	6.2	-	171.4	95.3	54.2	-	243.4	6.4	21.3	6.3	-	0.3	-	-	13.5	618.3	618.3
1988	0.1	-	388.5	773.3	55.9	-	103.8	-	59.1	6.1	95.2	0.1	14.1	5.6	1501.8	1501.8	1501.8
1989	4.3	-	249.6	378.5	71.9	-	157.1	116.4	170.4	0.6	224.1	4.4	8.1	1.0	1386.4	1386.4	1386.4

Table 2. Monthly imports of bluefin tuna from Mediterranean countries in 1989 and 1990.

(unit:MT)

Year/Country	FRANCE		SPAIN		GREECE		TURKEY		MOROCCO		TUNISIA		PORTUGAL		ITALY		Total
	Month	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen	Fresh	
1989	Jan	-	-	10.1	-	10.8	-	35.7	-	-	-	-	-	-	-	-	-
	Feb	-	-	---	-	1.5	-	28.7	-	-	-	16.5	-	-	-	-	-
	Mar	0.1	-	1.0	-	8.4	-	17.9	1.9	-	-	38.7	-	-	-	-	-
	Apr	-	-	8.2	-	6.3	-	24.8	-	-	-	42.4	0.2	-	-	-	-
	May	3.2	-	65.2	-	0.7	-	0.4	-	47.9	-	88.1	0.2	2.5	-	-	-
	Jun	0.7	-	35.0	-	0.4	-	-	-	8.6	-	37.0	-	4.2	-	-	-
	Jul	-	-	0.4	-	-	-	-	-	-	-	-	0.2	0.3	-	-	-
	Aug	0.04	-	-	134.7	-	-	4.6	-	-	0.6	-	-	1.1	1.0	-	-
	Sept	-	-	-	173.9	2.1	-	5.1	114.1	-	-	-	3.8	-	-	-	-
	Oct	0.3	-	24.5	22.6	9.9	-	19.3	0.4	24.9	-	0.5	-	-	-	-	-
	Nov	-	-	51.1	47.3	16.5	-	6.2	-	40.0	-	0.3	-	-	-	-	-
	Dec	-	-	54.1	-	15.3	-	14.4	-	49.0	-	0.6	-	-	-	-	-
Total		4.3	-	249.6	378.5	71.9	-	157.1	116.4	170.4	0.6	224.1	4.4	8.1	1.0	1386.4	1386.4
1990	Jan	-	-	43.3	-	5.4	-	33.3	-	29.5	-	16.8	-	-	-	-	-
	Feb	-	-	33.0	-	2.7	-	10.2	-	-	-	64.2	-	-	-	-	-
	Mar	5.6	-	2.4	-	17.1	-	8.5	-	-	-	90.9	-	-	-	-	-
	Apr	14.5	-	34.9	-	1.2	-	43.0	-	-	-	28.4	-	-	-	-	-
	Total	20.1	-	113.6	-	26.4	-	95.0	-	29.5	-	200.3	-	-	-	484.9	484.9

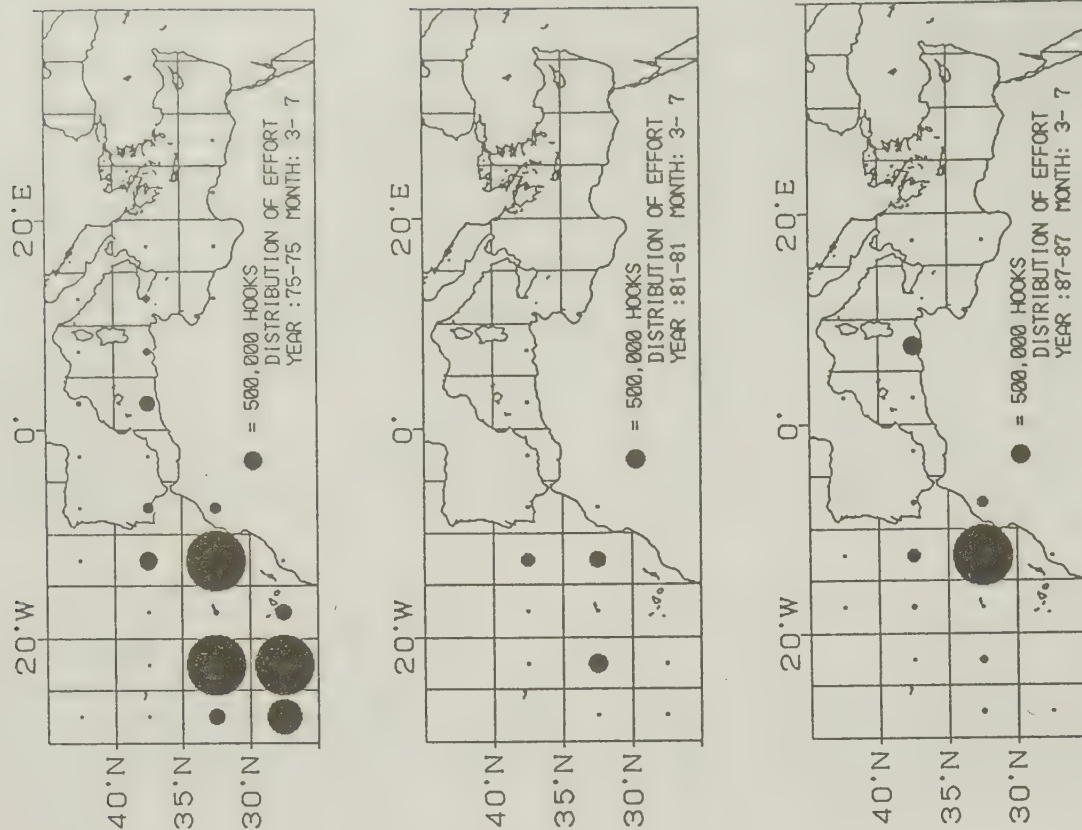


Fig. 2. Distribution of fishing effort (in number of hook) for the Japanese longline fishery by 5-degree square during bluefin fishing season (March - July).

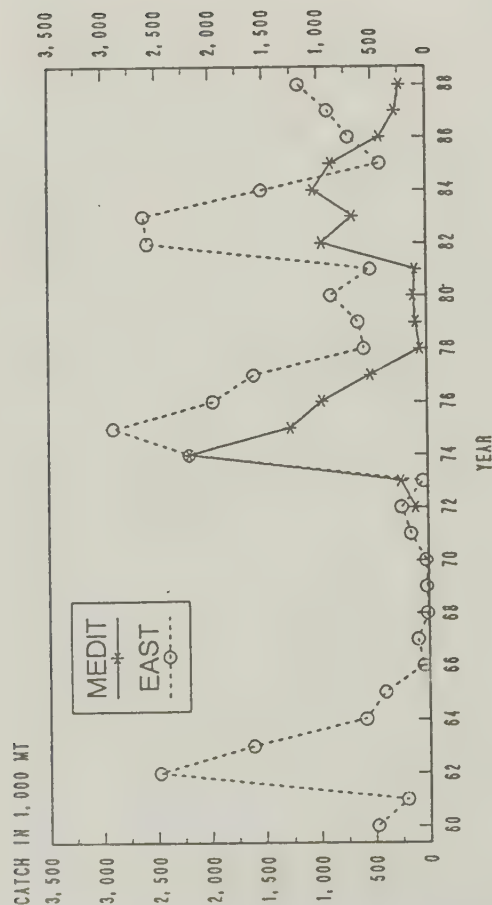


Fig. 1. Japanese annual catch of bluefin tuna in the eastern Atlantic and Mediterranean.

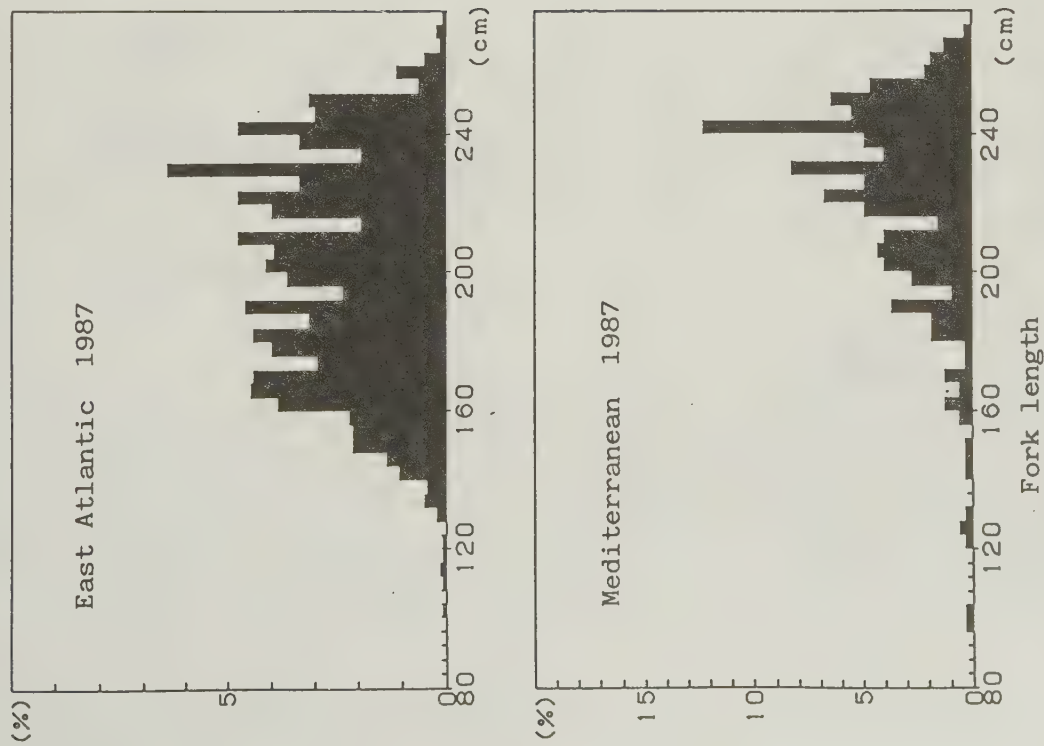


Fig. 5. Length frequency of bluefin tuna caught by the Japanese longline fishery.

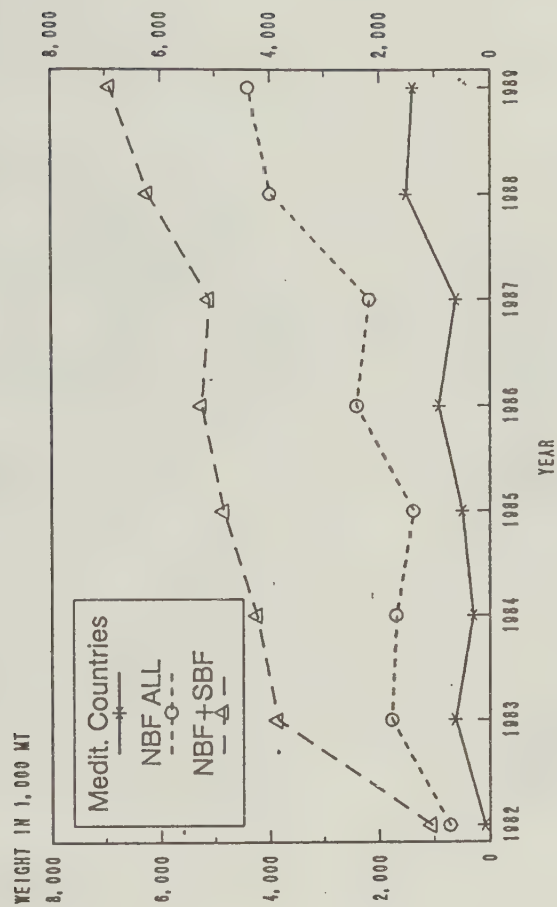


Fig. 6. Imports of bluefin tuna to Japan.

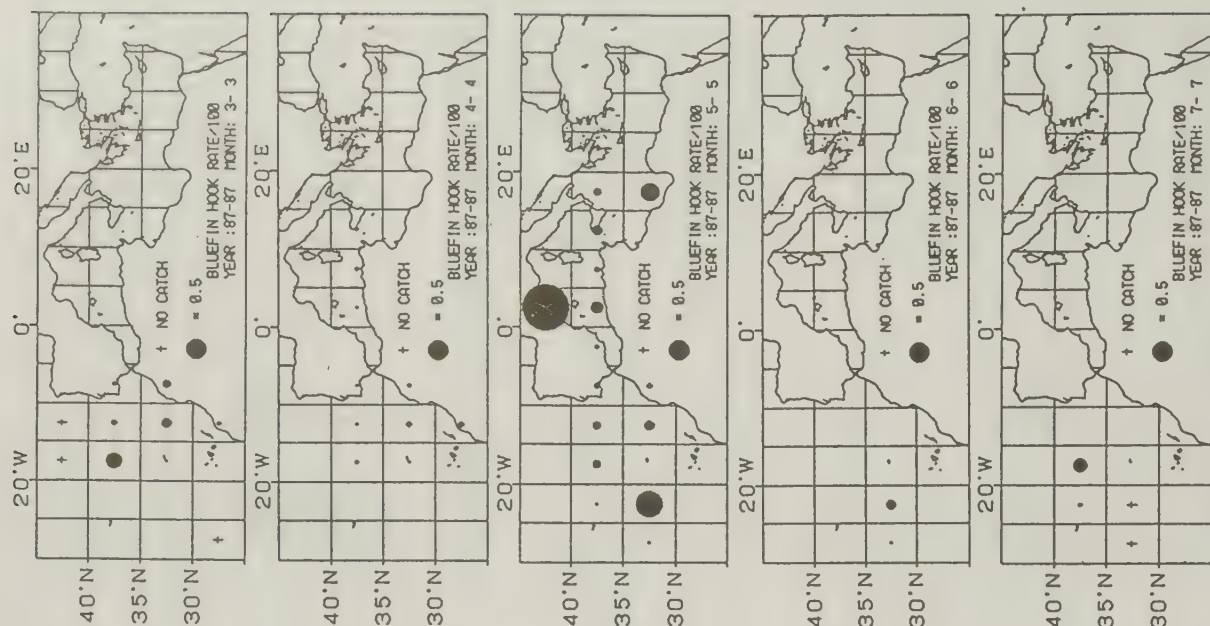


Fig. 4. Distribution of bluefin CPUE (catch in number per 100 hooks) for the Japanese longline fishery by 5-degree square and month in 1987.

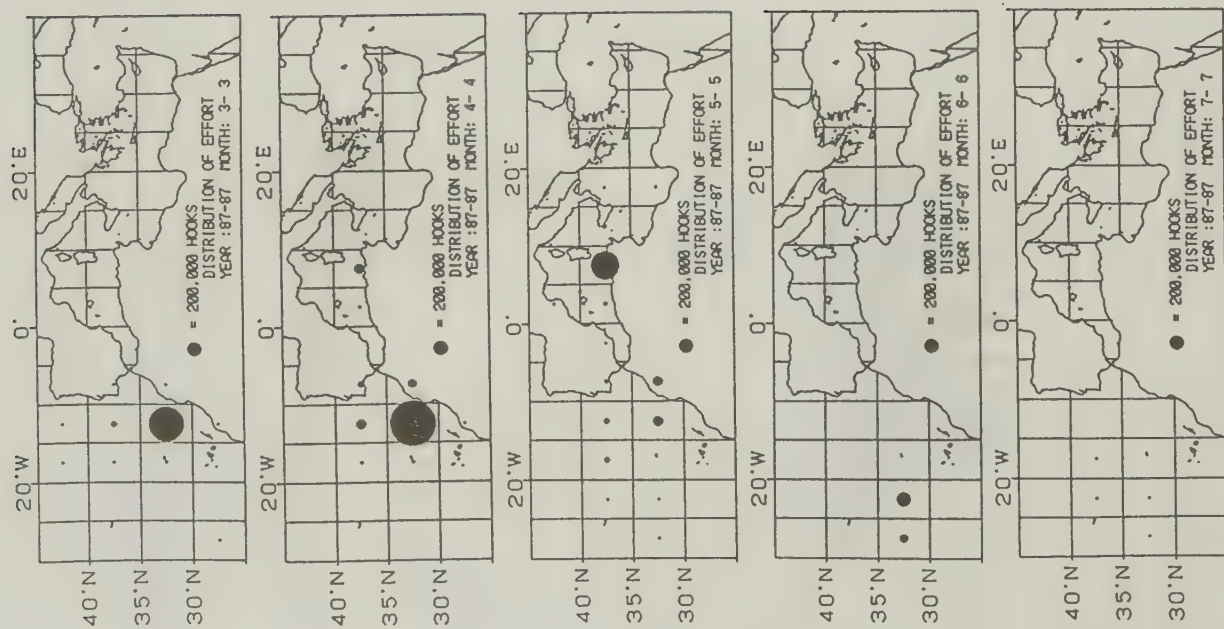


Fig. 3. Distribution of fishing effort (in number of hook) for the Japanese longline fishery by 5-degree square and month in 1987.

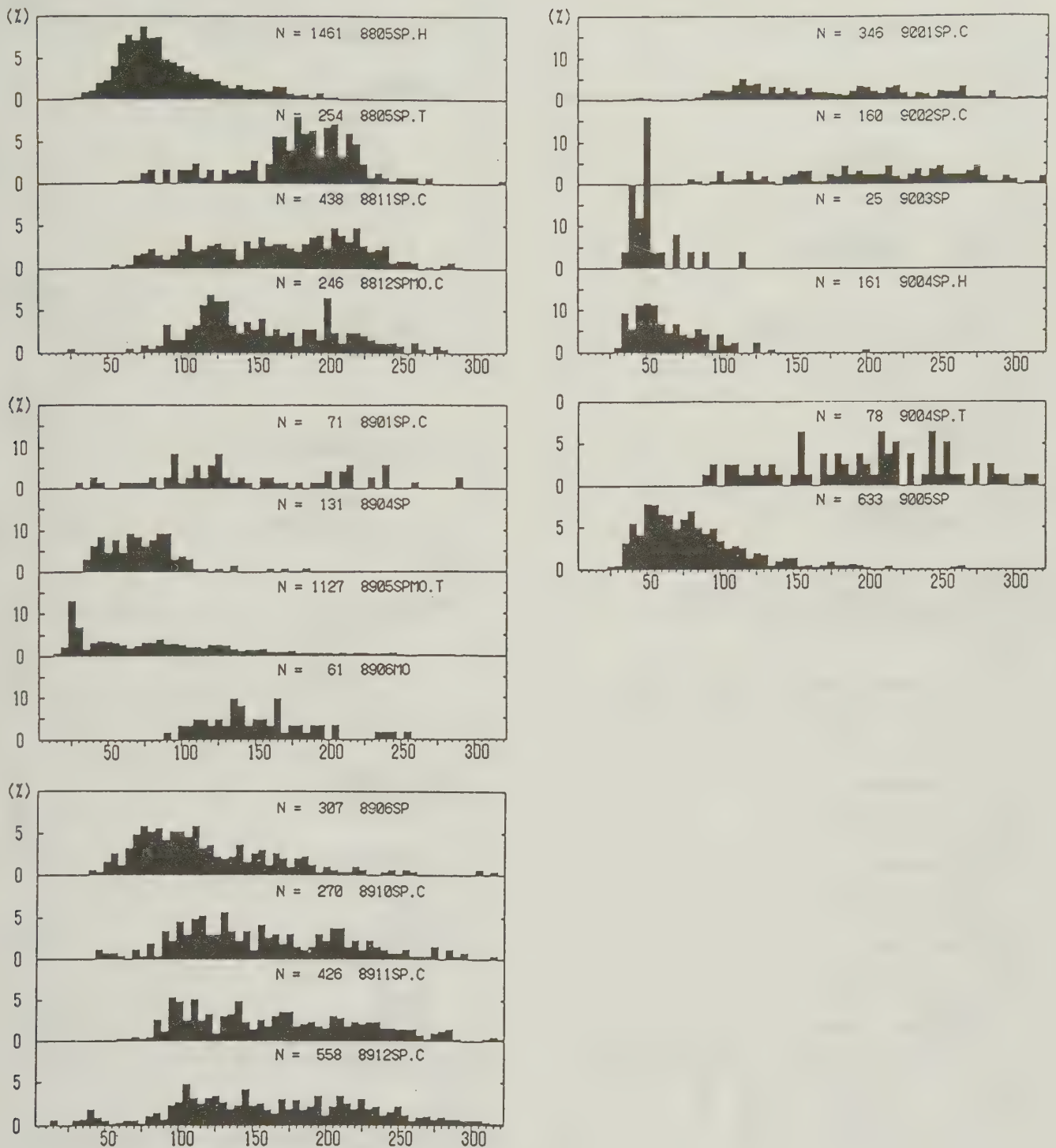


Fig. 7-1. Dressed-weight (kg) frequency of bluefin tuna imported into Japan from Spain and Morocco. "N" means the number of samples and right-hand-side letters show year (first 2 digits), month (second 2 digits), country (3rd and 4th letters before ".") and gear (1 letter after "."). Abbreviations for country and gear are as follow: SP=Spain, MO=Morocco, TR=Turkey, GR=Greece, TN=Tunisia, FR=France; P=purse seine, T=trap, C=cultivated, H=hand line.

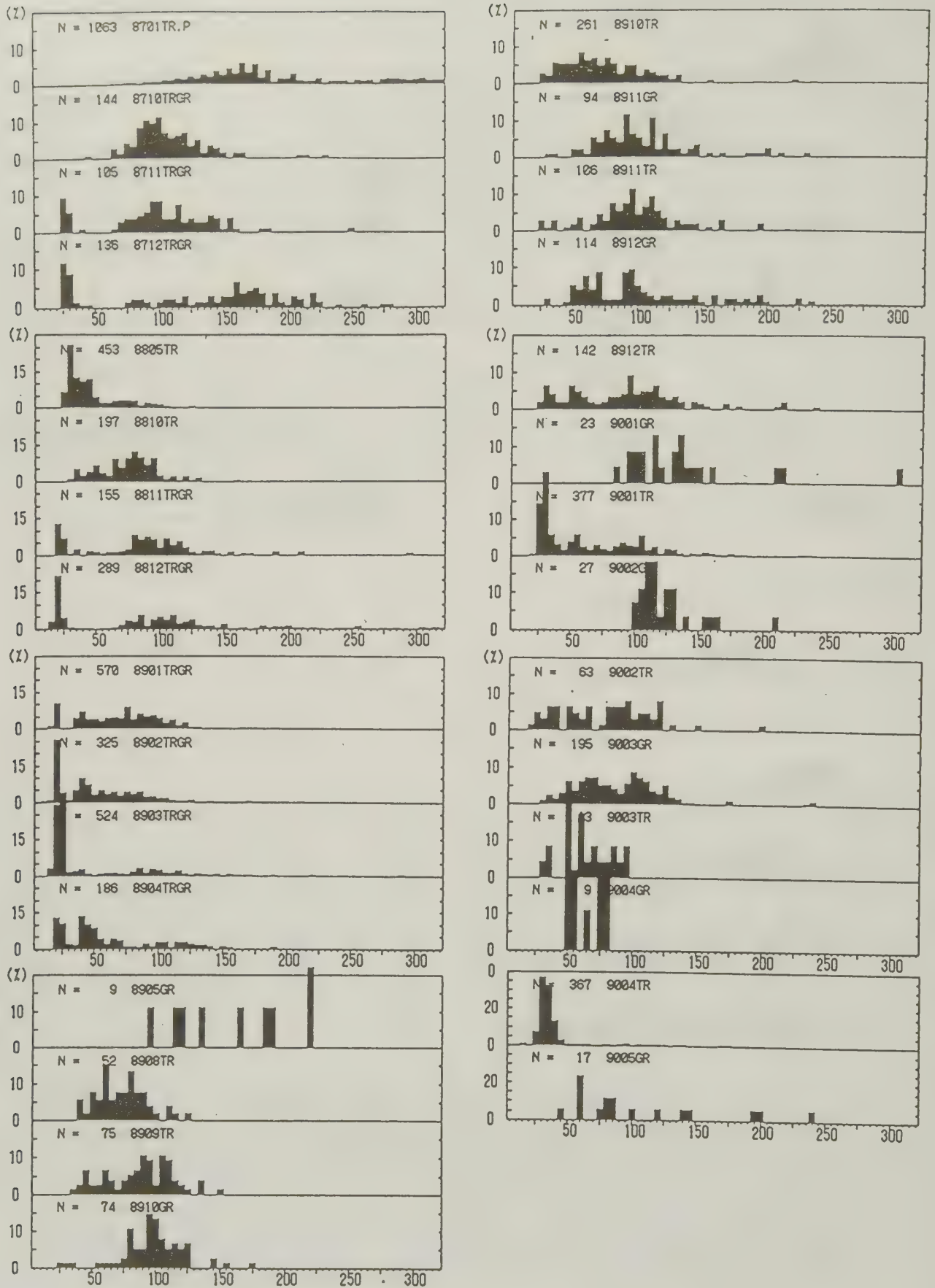


Fig. 7-2. Dressed-weight (kg) frequency of bluefin tuna imported into Japan from Turkey and Greece.

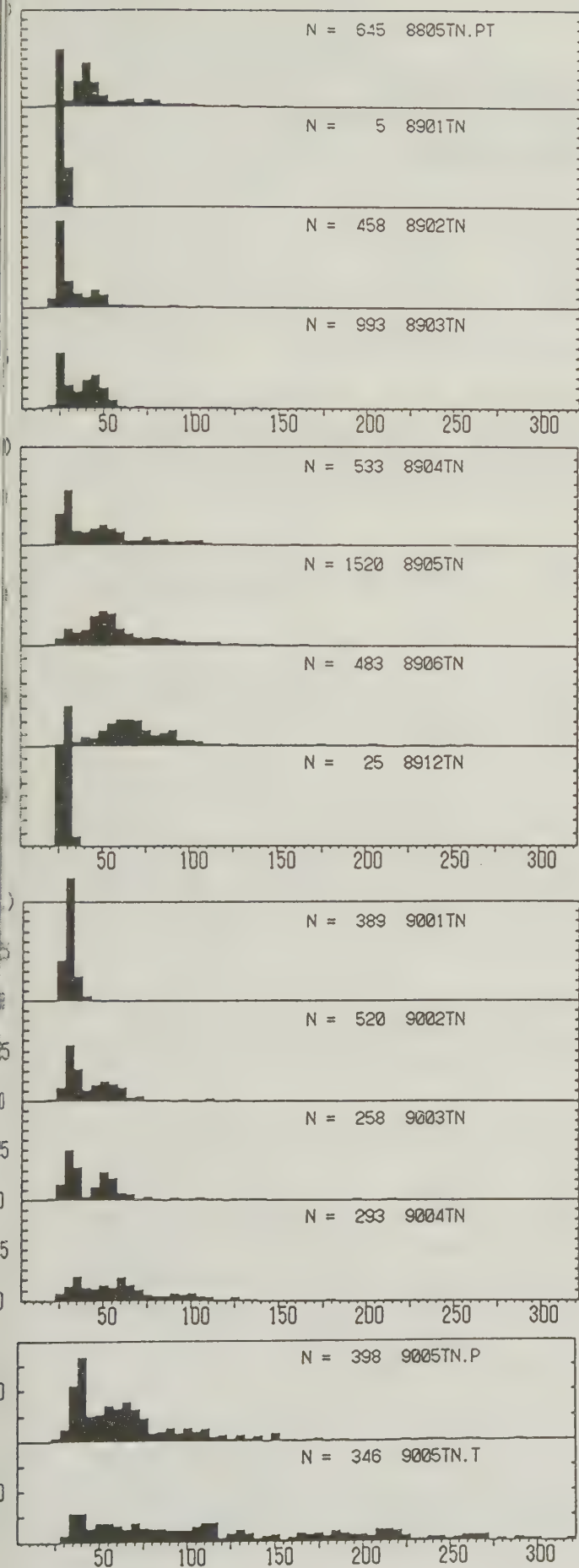


Fig. 7-3. Dressed-weight (kg) frequency of bluefin tuna imported into Japan from Tunisia.

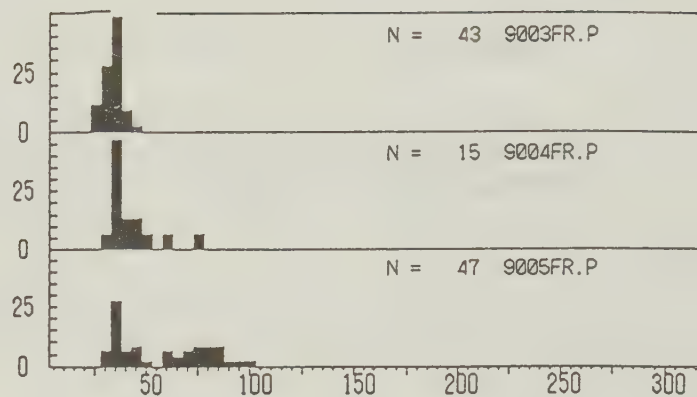


Fig. 7-4. Dressed-weight (kg) frequency of bluefin tuna imported into Japan from France.

NOTES ON THE DATA BASE FOR THE HIGHLY MIGRATORY SPECIES IN THE MEDITERRANEAN

By P. M. Miyake
ICCAT Secretariat

1. Background on the ICCAT data base for tunas and tuna-like species

Since the International Commission for the Conservation of Atlantic Tunas (ICCAT) was established in 1969, one of its primary interests has been to set up and maintain a good data base for all tunas. The Commission's Standing Committee on Research and Statistics (SCRS) established the following criteria for the collection of data:

- i) Annual nominal total catches by species, gear, nationality of the fishing vessels, and by large geographical area (contained in the Commission's "Statistical Bulletin" series).
- ii) Catch and effort statistics by 1-degree latitude and 1-degree longitude rectangle (or 5 x 5 rectangle for longline fisheries only), by month, species, gear and flag (contained in the Commission's "Data Record" series).
- iii) Length frequencies by species, area (smallest by 1° x 1° rectangles and largest by ICCAT sampling areas), by month (or quarter for longline fisheries), by gear and by flag. The sampling areas for bluefin tuna are shown in Figure 1. The length measurement of bluefin tuna should be expressed in fork length; the length intervals should be 1 cm for small fish and they could be 2 cm for large fish (Summary of data is contained in the Commission's "Data Records" series).
- iv) Catch at length for selected species, including bluefin and albacore tunas and swordfish, by specific area (for bluefin: east Atlantic, west Atlantic and Mediterranean), and by month or quarter (see Section 2.2, below).
- v) Tagging release and recovery data, with detailed information on releases and recoveries (see Section 2.3, below).

The national offices are responsible for submitting data to the Commission and ICCAT's Sub-Committee on Statistics is responsible for monitoring the collection of data. The Secretariat is in charge of managing all the data received, including verification of the data and checking for adequacy of data. When there is a lack of data or only insufficient data are available for a specific fishery, the Secretariat staff often visits the area concerned to help solving problems in the sampling system.

This paper was prepared for the Joint GFCM/ICCAT Expert Consultation on Evaluation of Stocks of Large Pelagic Fishes in the Mediterranean Area (Bari, Italy, June 21-27, 1990). No citations are permitted without a written authorization of the author.

2. Current data bases

2.1. Actual basic data

The nominal catch data are updated (up to and including 1988); the preliminary 1989 data will be compiled by September, 1990.

Detailed catch and effort data are behind by a few months to one year to the nominal catch data, particularly for Japanese longline data, since the logbook records cannot be assembled until the end of the fishing trips which may last as long as 14 months.

Actual size data are not available for all the fisheries, even for those for which we have catch-at-length data. For example, France (Mediterranean) submits catch-at-length data, but does not submit actual size frequencies. The data are about one-half year behind the nominal catch data.

2.2 Catch-at-length files

a) *Bluefin tuna*

In the late 1970's, there were indications of a reduction in the bluefin stocks, particularly for the west Atlantic. The Commission decided to conduct an intensive research program on Atlantic bluefin tuna in order to gather all the data available. The following meetings have been held by the Commission for this purpose:

- a) A workshop in Santander (Spain) in September, 1979 (Collective Volume of Scientific Papers, XI, ICCAT, 1980).
- b) A data preparatory meeting in Trapani (Sicily) in May, 1983 (Coll. Vol. Sci. Pap. XIX, ICCAT, 1984).
- c) A workshop in Tsukuba and Shimizu (Japan) in September, 1983 (Coll. Vol. Sci. Pap. XIX, ICCAT, 1984).

During all these sessions, the scientists agreed to carry out stock assessments of bluefin tuna by applying Virtual Population Analysis (VPA) and the creation of the data base required for such analysis was initiated. Also, it was agreed to conduct stock assessments based on a two-stock hypothesis; i.e. an east Atlantic stock which includes Mediterranean bluefin and a west Atlantic stock (see Figure 1). With this in mind, the scientists and the Secretariat gathered all the basic data available and created a catch-at-length file for the east and west Atlantic and Mediterranean.

Since then, the catch-at-length base has been up-dated each year for the latest year and whenever historical catch data are changed or new size data become available. The base is maintained as a working file in the computer separately from the basic data, such as actual size frequencies.

In principle, each national office is responsible for updating these data. However, the Secretariat has to update the catch-at-length base for all the fisheries, with the

exception of a few countries which create these files by themselves. The updating procedures applied by the Secretariat for catch at length have been reported in the following papers:

SCRS/84/26	Coll. Vol. Sci. Pap. XXII, ICCAT, 1985
SCRS/85/20	Coll. Vol. Sci. Pap. XXIV, ICCAT, 1986
SCRS/86/10	Coll. Vol. Sci. Pap. XXVI, ICCAT, 1987
SCRS/87/19	Coll. Vol. Sci. Pap. XXVIII, ICCAT, 1988
SCRS/88/64	Coll. Vol. Sci. Pap. XXX(2), ICCAT, 1989
SCRS/89/8	Coll. Vol. Sci. Pap. XXXII(2), ICCAT, 1990

The latest catch-at-length base was prepared in November, 1989, for the scientific meeting of the Commission (up to and including the base for 1988). However, much of the data used for 1988 were preliminary and hence have been modified and updated at this time. The data substitutions and raising procedures adopted at this time are listed in Table 1.

For the catch-at-length data, only three areas have been adopted as shown in Figure 2. In the data base, all the frequencies are kept by 1 cm intervals. If the data are received in intervals larger than 1 cm, they are equally distributed into centimeters. The records are kept by gear and by month for the west Atlantic, and by month or quarter for the rest. However, they are merged and summed up for the application of analytical programs.

b) Swordfish

ICCAT held two workshops on swordfish (Oct. 6-13, 1987 and Sep. 6-13, 1988). At the first workshop, application of VPA to the catch at age was agreed upon and a data base was created up to 1986 for the North Atlantic. Due to time constraints, no VPA application was made in this year. The scientists agreed to consider the North Atlantic (north of 5 degrees North) as one stock. There was no data base created for the Mediterranean. This was due to the lack of data and not because the Mediterranean stock was considered to be separate from the one in the North Atlantic. At the same time, length-weight conversion, growth and natural mortality were discussed and agreed upon, at least for the North Atlantic.

At the 1988 Workshop, the north Atlantic base was updated and VPA was applied for the first time. Mediterranean swordfish data continued to be very inadequate to warrant creating any data base of catch at size.

At the 1989 swordfish stock assessment session, the data base for the North Atlantic was again updated. The base now includes catch at size up to 1988. Data matching, data substitutions, and raising carried out by the Secretariat on north Atlantic swordfish are documented in the following papers:

SCRS/87/17 Coll. Vol. Sci. Pap. XXVII, ICCAT, 1988
Workshop Rpt Coll. Vol. Sci. Pap. XXIX, ICCAT, 1989
SCRS/89/9 Coll. Vol. Sci. Pap. XXXII(2), ICCAT, 1989

The ICCAT Secretariat has updated this North Atlantic data base as of June 10, 1990, including all the changes in catch and additional size data. At the same time, a trial was made to create a catch-at-size base for the Mediterranean swordfish. The data matching, substitutions and raising carried out for this purpose are listed in Table 2.

c) Albacore and other tuna-like species

The ICCAT scientists have worked on albacore data and created a catch-at-size base for the North Atlantic, for 1978 through 1988. The work is described in the Albacore Workshop Report (Coll. Vol. Sci. Pap. XXXI). Although there have been considerable catches of albacore by the Mediterranean coastal fisheries, no data base has been created for the Mediterranean albacore, not because the stock is considered as separate but because of the lack of size data. No attempt was made to match the Mediterranean albacore catches with size data, at this time, since the catch data are not quite complete or size data are inadequate.

2.3 Data coverage

The confidence in the bluefin catch-at-size data base thus created has been challenged many times by ICCAT scientists, particularly in the case of the Mediterranean data. The base contains many data substitutions, and high raising factors have been applied for some catches (i.e. a very small sample is extrapolated to a large catch). Table 3 lists the levels of sampling and the data substitutions applied for each bluefin fishery in the Mediterranean. This type of table was not created for swordfish since Table 2 gives data substitution as well as other information to evaluate the sampling level for each fishery.

The sampling level is summarized in Tables 4 and 5. These Tables could be somewhat misleading, since the importance of sampling is not the total number of fish measured but by how well the sampling has been stratified. Therefore, these Tables should be studied together with Tables 2 and 3. Nevertheless, it is very clear that many catches have no matching size data. Hence, size data from other fisheries or other years have been used as substitution. The conclusion is that the level of sampling is far from satisfactory to carry out any meaningful VPA type of analysis.

3. Tagging files

The tagging data files are fragmental. It was the Commission's intention to put all the tagging records into one format and one file. However, this has never been realized, for the following reasons;

- i) The release information for fish which have never been recovered is not very well documented and is not always submitted to the Commission by the agencies actually carrying out the tagging. Particularly, information on old releases is often lost or difficult to find.
- ii) There are many errors in the existing tag recovery files due to misreporting, double

reporting, mis-entries, lack of verification of data.

- iii) The Secretariat has not been able to work on the historical data, due to time constraints.

At present, release and recovery information for those tags already recovered has been kept in computer files since 1979. This has been possible only because ICCAT has been holding annual tagging lotteries for recovered tags. The files are, however, in various formats and in two distinct coding systems, since the system was changed in the course of time. The outline of the tagging files and a summary of the results are reported by Miyake (History of the ICCAT tagging program, 1971-1986, In Proceedings of the International Symposium and Educational Workshop on Fish Marking Techniques, Seattle, in press).

Table 1. Updating made on ICCAT catch at size data prepared in November, 1989
(East Atlantic and Mediterranean bluefin)

N E W D A T A						O L D D A T A				
AREA	COUNTRY	GEAR	YR	CATCH KG	R.F.	AREA	COUNTRY	GEAR	YR	REMARKS
EAST	SPAIN	GILL	88	4000	0.00192	EAST	SPAIN	BB	88	SUB TASKI = 208200
EAST	JAPAN	LL	88	1169000	1.46125	EAST	JAPAN	LL	88	OLD TASKI = 80000
EAST	DENMARK	UNCL	85	2000	0.06452	EAST	NORWAY	PS	86	SUB TASKI = 3100
MED	SPAIN	TRAP	88	228000	1.13433	MED	SPAIN	TRAP	88	OLD TASKI = 20100
MED	JAPAN	LL	88	236000	0.94400	MED	JAPAN	LL	88	OLD TASKI = 25000
MED	TUNISIE	TRAP	88	100000	1.20482	MED	TUNISIE	TRAP	88	OLD TASKI = 8300

TABLE 2. Mediterranean swordfish data matching and substitutions.

CATCH DATA AVAILABLE					MATCHED SIZE DATA (OR SUBSTITUTED DATA)							
COUNTRY	YR	TIME	GEAR	CATCH MT	COUNTRY	GEAR	YR	TIME	SAMPLE KG	#	R.F.	REMARKS
ALGERIE	78	0	UNCL	320	SPAIN	LLHB	78	0			44.81730	SP EST'D WGT= 7140.1
ALGERIE	79	0	UNCL	521	SPAIN	LLHB	79	0			53.39154	SP EST'D WGT= 9758.1
ALGERIE	80	0	UNCL	650	SPAIN	LLHB	80	0			32.77383	SP EST'D WGT= 19832.9
ALGERIE	81	17	UNCL	760	SPAIN	LLHB	81	17			0.67857	SPAN. TASKI = 1120000
ALGERIE	82	17	UNCL	870	SPAIN	LLHB	82	17			0.96667	SPAN. TASKI = 900000
ALGERIE	83	0	UNCL	877	SPAIN	LLHB	84	0			0.70555	SPAN. TASKI = 1243000
ALGERIE	84	0	UNCL	884	SPAIN	LLHB	84	0			0.71118	SPAN. TASKI = 1243000
ALGERIE	85	0	UNCL	890	SPAIN	LLHB	85	0			0.73011	SPAN. TASKI = 1219000
ALGERIE	86	0	UNCL	847	SPAIN	LLHB	86	0			0.63351	SPAN. TASKI = 1337000
ALGERIE	87	0	UNCL	1820	SPAIN	LLHB	88	0			1.03409	SPAN. TASKI = 1760000
ALGERIE	88	0	UNCL	2621	SPAIN	LLHB	88	0			1.48920	SPAN. TASKI = 1760000
CYPRUS	78	0	LL	82	SPAIN	LLHB	78	0			11.48443	SP EST'D WGT= 7140.1
CYPRUS	79	0	LL	98	SPAIN	LLHB	79	0			10.04294	SP EST'D WGT= 9758.1
CYPRUS	80	0	LL	72	SPAIN	LLHB	80	0			3.63033	SP EST'D WGT= 19832.9
CYPRUS	81	17	LL	78	SPAIN	LLHB	81	17			0.06964	SPAN. TASKI = 1120000
CYPRUS	82	17	LL	103	SPAIN	LLHB	82	17			0.11444	SPAN. TASKI = 900000
CYPRUS	83	0	LL	28	SPAIN	LLHB	84	0			0.02253	SPAN. TASKI = 1243000
CYPRUS	84	0	LL	63	SPAIN	LLHB	84	0			0.05068	SPAN. TASKI = 1243000
CYPRUS	85	0	LL	71	SPAIN	LLHB	85	0			0.05824	SPAN. TASKI = 1219000
CYPRUS	86	0	LL	154	GREECE	LL	86	0			0.06720	GRC EST CATCH 2291724
CYPRUS	87	0	LL	84	GREECE	LL	87	0			0.05728	GRC EST CATCH 1466372
CYPRUS	88	0	LL	121	GREECE	LL	87	0			0.08252	GRC EST CATCH 1466372
GREECE	81	17	LL	91	SPAIN	LLHB	81	17			0.08125	SPAN. TASKI = 1120000
GREECE	82	17	LL	690	SPAIN	LLHB	82	17			0.76667	SPAN. TASKI = 900000
GREECE	83	0	LL	689	SPAIN	LLHB	84	0			0.55430	SPAN. TASKI = 1243000
GREECE	84	0	LL	965	SPAIN	LLHB	84	0			0.77635	SPAN. TASKI = 1243000
GREECE	85	0	LL	925	SPAIN	LLHB	85	0			0.75882	SPAN. TASKI = 1219000
GREECE	86	0	LL	1535						1091	1.00000	RAISED BY GREEK SCI *
GREECE	87	0	LL	1110						1100	1.00000	RAISED BY GREEK SCI**
GREECE	88	0	LL	1251	GREECE	LL	87	0			0.85313	GRC EST CATCH= 1466372
ITALY	78	0	LLHB	3348	SPAIN	LLHB	78	0			468.90100	SP EST'D WGT= 7140.1
ITALY	78	0	HARP	675	SPAIN	LLHB	78	0			94.53649	SP EST'D WGT= 7140.1
ITALY	79	0	LLHB	3085	SPAIN	LLHB	79	0			316.14761	SP EST'D WGT= 9758.1
ITALY	79	0	HARP	424	SPAIN	LLHB	79	0			43.45108	SP EST'D WGT= 9758.1
ITALY	80	0	LLHB	3252	SPAIN	LLHB	80	0			163.96997	SP EST'D WGT= 19832.9
ITALY	80	0	HARP	447	SPAIN	LLHB	80	0			22.53831	SP EST'D WGT= 19832.9
ITALY	81	17	LLHB	3002	SPAIN	LLHB	81	17			2.68036	SPAN. TASKI= 1120000
ITALY	81	17	HARP	412	SPAIN	LLHB	81	17			0.36786	SPAN. TASKI= 1120000
ITALY	82	17	LLHB	2306	SPAIN	LLHB	82	17			2.56222	SPAN. TASKI= 900000
ITALY	82	17	HARP	318	SPAIN	LLHB	82	17			0.35333	SPAN. TASKI= 900000
ITALY	83	0	LLHB	2375	SPAIN	LLHB	84	0			1.91070	SPAN. TASKI= 1243000
ITALY	83	0	HARP	327	SPAIN	LLHB	84	0			0.26307	SPAN. TASKI= 1243000
ITALY	84	0	LLHB	2463	SPAIN	LLHB	84	0			1.98150	SPAN. TASKI= 1243000
ITALY	84	0	TRAP	3	SPAIN	LLHB	84	0			0.00241	SPAN. TASKI= 1243000
ITALY	84	0	UNCL	4588	SPAIN	LLHB	84	0			3.69107	SPAN. TASKI= 1243000
ITALY	84	0	GILL	1303	SPAIN	LLHB	84	0			1.04827	SPAN. TASKI= 1243000
ITALY	85	0	LLHB	2226	SPAIN	LLHB	85	0			1.82609	SPAN. TASKI= 1219000
ITALY	85	0	UNCL	6098	SPAIN	LLHB	85	0			5.00246	SPAN. TASKI= 1219000
ITALY	85	0	GILL	1375	SPAIN	LLHB	85	0			1.12797	SPAN. TASKI= 1219000
ITALY	86	0	LLHB	2341	SPAIN	LLHB	86	0			1.75093	SPAN. TASKI= 1337000
ITALY	86	0	UNCL	6403	SPAIN	LLHB	86	0			4.78908	SPAN. TASKI= 1337000
ITALY	86	0	GILL	1446	SPAIN	LLHB	86	0			1.08153	SPAN. TASKI= 1337000
ITALY	87	0	LLHB	2528	SPAIN	LLHB	88	0			1.43636	SPAN. TASKI= 1760000
ITALY	87	0	UNCL	6915	SPAIN	LLHB	88	0			3.92898	SPAN. TASKI= 1760000
ITALY	87	0	GILL	1562	SPAIN	LLHB	88	0			0.88750	SPAN. TASKI= 1760000
ITALY	88	0	LLHB	2669	SPAIN	LLHB	88	0			1.51648	SPAN. TASKI= 1760000
ITALY	88	0	UNCL	7299	SPAIN	LLHB	88	0			4.14716	SPAN. TASKI= 1760000
ITALY	88	0	GILL	1648	SPAIN	LLHB	88	0			0.93636	SPAN. TASKI= 1760000
JAPAN	78	0	LL	2			0		2077	19	1.00000	
JAPAN	79	0	LL	3			0		928	12	3.23171	
JAPAN	80	0	LL	1			0		15090	107	1.00000	
JAPAN	81	0	LL	1			0		12011	106	1.00000	
JAPAN	82	0	LL	5			0		332	2	15.06932	

TIME 0=MONTHLY OR QUARTERLY DATA DATA
17=YEARLY DATA

TABLE 2. Continued...

CATCH DATA AVAILABLE				MATCHED SIZE DATA (OR SUBSTITUTED DATA)								R.F.	REMARKS
COUNTRY	YR	TIME	GEAR	CATCH MT	COUNTRY	GEAR	YR	TIME	SAMPLE KG	#			
JAPAN	83	0	LL	6					6827	70	1.00000		
JAPAN	84	0	LL	19					24698	257	1.00000		
JAPAN	85	0	LL	14					14694	156	1.00000		
JAPAN	86	0	LL	7					10794	127	1.00000		
JAPAN	87	0	LL	3					422	6	7.11575		
JAPAN	88	0	LL	4	JAPAN	LLHB	87	0			9.34579	SAMPLE WEIGHT	428
MALTA	78	0	UNCL	121	SPAIN	LLHB	78	0			16.94654	SP EST'D WGT=	7140.1
MALTA	79	0	UNCL	135	SPAIN	LLHB	79	0			13.83466	SP EST'D WGT=	9758.1
MALTA	80	0	UNCL	198	SPAIN	LLHB	80	0			9.98341	SP EST'D WGT=	19832.9
MALTA	81	17	UNCL	171	SPAIN	LLHB	81	17			0.15268	SPAN. TASKI =	1120000
MALTA	82	17	UNCL	158	SPAIN	LLHB	82	17			0.17556	SPAN. TASKI =	900000
MALTA	83	0	UNCL	53	SPAIN	LLHB	84	0			0.04264	SPAN. TASKI =	1243000
MALTA	84	0	UNCL	84	SPAIN	LLHB	84	0			0.06758	SPAN. TASKI =	1243000
MALTA	85	0	UNCL	96	SPAIN	LLHB	85	0			0.07875	SPAN. TASKI =	1219000
MALTA	86	0	UNCL	87	SPAIN	LLHB	86	0			0.06507	SPAN. TASKI =	1337000
MALTA	87	0	UNCL	117	SPAIN	LLHB	88	0			0.06648	SPAN. TASKI =	1760000
MALTA	88	0	UNCL	185	SPAIN	LLHB	88	0			0.10511	SPAN. TASKI =	1760000
MOROCCO	78	0	LL	172	SPAIN	LLHB	78	0			24.08930	SP EST'D WGT=	7140.1
MOROCCO	83	0	LL	43	SPAIN	LLHB	84	0			0.03459	SPAN. TASKI =	1243000
MOROCCO	84	0	LL	39	SPAIN	LLHB	84	0			0.03138	SPAN. TASKI =	1243000
MOROCCO	85	0	LL	37	SPAIN	LLHB	85	0			0.03035	SPAN. TASKI =	1219000
MOROCCO	86	0	LL	99	SPAIN	LLHB	86	0			0.07405	SPAN. TASKI =	1337000
MOROCCO	87	0	LL	39	SPAIN	LLHB	88	0			0.02216	SPAN. TASKI =	1760000
MOROCCO	88	0	LL	62	SPAIN	LLHB	88	0			0.03523	SPAN. TASKI =	1760000
SPAIN	78	0	LLHB	720					7140	179	133.00000	R.F. BY SPAN SCI.***	
SPAIN	79	0	LLHB	800					9758	223	111.00000	R.F. BY SPAN SCI.***	
SPAIN	80	0	LLHB	750					19833	471	50.00000	R.F. BY SPAN SCI.***	
SPAIN	81	17	LLHB	1120				17		457	1.00000	RAISED BY SPANISH SCI.	
SPAIN	82	17	LLHB	900				17		1461	1.00000	RAISED BY SPANISH SCI.	
SPAIN	83	0	LLHB	1321	SPAIN	LLHB	84	0			1.06275	SPAN. TASKI =	1243000
SPAIN	83	0	TRAP	1	SPAIN	LLHB	84	0			0.00080	SPAN. TASKI =	1243000
SPAIN	84	0	LLHB	1243					278965	12532	1.00000	RAISED BY SPANISH SCI.	
SPAIN	84	0	TRAP	2	SPAIN	LLHB	84	0			0.00161	SPAN. TASKI =	1243000
SPAIN	85	0	LLHB	1219							1.00000	RAISED BY SPANISH SCI.	
SPAIN	85	0	TRAP	3	SPAIN	LLHB	85	0			0.00246	SPAN. TASKI =	1219000
SPAIN	85	0	SURF	2	SPAIN	LLHB	85	0			0.00164	SPAN. TASKI =	1219000
SPAIN	85	0	UNCL	1	SPAIN	LLHB	85	0			0.00082	SPAN. TASKI =	1219000
SPAIN	85	0	TRAW	1	SPAIN	LLHB	85	0			0.00082	SPAN. TASKI =	1219000
SPAIN	85	0	HAND	1	SPAIN	LLHB	85	0			0.00082	SPAN. TASKI =	1219000
SPAIN	86	0	LLHB	1337							1.00000	RAISED BY SPANISH SCI.	
SPAIN	87	0	LLHB	1134	SPAIN	LLHB	88	0			0.64432	SPAN. TASKI =	1760000
SPAIN	88	0	LLHB	1760							1.00000	RAISED BY SPANISH SCI.	
SPAIN	88	0	TRAP	2	SPAIN	LLHB	88	0			0.00114	SPAN. TASKI =	1760000
TUNISIE	81	17	UNCL	7	SPAIN	LLHB	81	17			0.00625	SPAN. TASKI =	1120000
TUNISIE	82	17	UNCL	19	SPAIN	LLHB	82	17			0.02111	SPAN. TASKI =	900000
TUNISIE	83	0	UNCL	15	SPAIN	LLHB	84	0			0.01207	SPAN. TASKI =	1243000
TUNISIE	84	0	UNCL	15	SPAIN	LLHB	84	0			0.01207	SPAN. TASKI =	1243000
TUNISIE	85	0	UNCL	61	SPAIN	LLHB	85	0			0.05004	SPAN. TASKI =	1219000
TUNISIE	86	0	UNCL	64	SPAIN	LLHB	86	0			0.04787	SPAN. TASKI =	1337000
TUNISIE	87	0	UNCL	63	SPAIN	LLHB	88	0			0.03580	SPAN. TASKI =	1760000
TUNISIE	88	0	UNCL	80	SPAIN	LLHB	88	0			0.04545	SPAN. TASKI =	1760000
TURKEY	78	0	UNCL	20	SPAIN	LLHB	78	0			2.80108	SP EST'D WGT=	7140.1
TURKEY	79	0	UNCL	44	SPAIN	LLHB	79	0			4.50907	SP EST'D WGT=	9758.1
TURKEY	80	0	UNCL	13	SPAIN	LLHB	80	0			0.65548	SP EST'D WGT=	19832.9
TURKEY	81	17	UNCL	70	SPAIN	LLHB	81	17			0.06250	SPAN. TASKI =	1120000
TURKEY	82	17	UNCL	40	SPAIN	LLHB	82	17			0.04444	SPAN. TASKI =	900000
TURKEY	83	0	UNCL	216	SPAIN	LLHB	84	0			0.17377	SPAN. TASKI =	1243000
TURKEY	84	0	UNCL	95	SPAIN	LLHB	84	0			0.07643	SPAN. TASKI =	1243000
TURKEY	85	0	GILL	190	SPAIN	LLHB	85	0			0.15587	SPAN. TASKI =	1219000
TURKEY	86	0	GILL	226	GREECE	LL	86	0			0.09862	GRC EST CATCH	2291724
TURKEY	87	0	GILL	557	GREECE	LL	87	0			0.37985	GRC EST CATCH	1466372
TURKEY	88	0	GILL	557	GREECE	LL	87	0			0.37985	GRC EST CATCH	1466372

TIME 0=MONTHLY OR QUARTERLY DATA DATA
17=YEARLY DATA

Table 3. Level of the substitutions made on the bluefin catch-at-size base 1984 - 1988

YEAR	COUNTRY	GEAR	CATCH	# FISH	SOURCE
EAST ATLANTIC					
1984	CAP VERT	BBF	1		1
1984	ESPANA	BB	2		1
1984	ESPANA	PS	41		1
1984	ESPANA	LLHB	7	66	2
1984	ESPANA	GILL	2		1
1984	ESPANA	BB	2364		2
1984	ESPANA	SURF	117		1
1984	ESPANA	TRAP	2271	1398	2
1984	FRANCE	TROL	36		1
1984	FRANCE	BB	566		1
1984	JAPAN	LLHB	1514	899	2
1984	MAROC	PS	127		1
1984	MAROC	SURF	44		1
1984	NORWAY	PS	243		3
1984	PANAMA	LLFB	17		1
1984	PORTUGAL	SURF	16		1
1984	PORTUGAL	BB	1		1
1984	PORTUGAL	BB	14		1
1984	PORTUGAL	PS	3	7	3
RAISE FROM SAMPLE			6402	2370	
SUBSTITUTED			984		
TOTAL			7386		
1985	ESPANA	BB	133	47	2
1985	ESPANA	BB	1850		2
1985	ESPANA	TRAP	1630		2
1985	ESPANA	TROL	1		1
1985	ESPANA	LLHB	16		1
1985	FRANCE	BB	380		1
1985	FRANCE	TROL	110		1
1985	JAPAN	LLHB	420	691	2
1985	KOREA	LLFB	77		1
1985	MAROC	PS	86		1
1985	PANAMA	LLFB	22		1
1985	PORTUGAL	SURF	25		2
1985	PORTUGAL	HAND	1	3	2
1985	PORTUGAL	BB	3	27	2
RAISED BY SAMPLE			4062	768	
SUBSTITUTED			692		
TOTAL			4754		
1986	DENMARK	UNCL	1		1
1986	ESPANA	BB	78	12	2
1986	ESPANA	BB	1875		2
1986	ESPANA	TRAP	891	1006	2
1986	ESPANA	PS	12	856	2
1986	ESPANA	LLHB	20		1
1986	FRANCE	BB	272		1
1986	FRANCE	TROL	76		1
1986	JAPAN	LLHB	710	939	2
1986	MAROC	PS	122		1
1986	NORWAY	PS	31	70	3
1986	PANAMA	LLFB	11		1
1986	PORTUGAL	SURF	41		2
1986	PORTUGAL	HAND	1	12	2
1986	PORTUGAL	BB	28	221	2
1986	PORTUGAL	PS	123	37	2
RAISED BY SAMPLE			3790	3153	
SUBSTITUTED			502		
TOTAL			4292		

YEAR	COUNTRY	GEAR	CATCH	#FISH	SOURCE
1987	ESPANA	BB	25	12	2
1987	ESPANA	BB	1512	2412	2
1987	ESPANA	TRAP	939		2
1987	FRANCE	BB	533		1
1987	JAPAN	LLHB	900	1741	2
1987	MAROC	TRAP	460		1
1987	PANAMA	LLFB	4		1
1987	PORTUGAL	SURF	102		1
1987	PORTUGAL	HAND	3	10	2
1987	PORTUGAL	BB	58		2
RAISED BY SAMPLE			3437	4175	
SUBSTITUTED			1099		
TOTAL			4536		
1988	ESPANA	BB	92	12	2
1988	ESPANA	BB	2082	5609	2
1988	ESPANA	TRAP	2389	275	2
1988	MAROC	SURF	202		1
1988	MAROC	TRAP	131		1
1988	POLAND	UNCL	2		1
1988	PORTUGAL	SURF	16		2
1988	PORTUGAL	HAND	1	30	2
1988	PORTUGAL	BB	29	6	2
RAISED BY SAMPLE			4609	5932	
SUBSTITUTED			335		
TOTAL			4944		

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1984	ALGERIE	UNCL	254		1
1984	ESPANA	GILL	3		1
1984	ESPANA	HAND	145	495	2
1984	ESPANA	BB	1699	834	2
1984	ESPANA	UNCL	101	592	2
1984	ESPANA	SURF	26	1173	2
1984	ESPANA	TRAP	621		2
1984	ESPANA	PS	79		1
1984	ESPANA	LLHB	69		2
1984	FRANCE	PSM	3570		2
1984	FRANCE	SPOR	30		1
1984	GREECE	UNCL	500		1
1984	ITALY	PSFS	993		1
1984	ITALY	PSFB	2476	3550	2
1984	ITALY	GILL	100		1
1984	ITALY	HAND	10		1
1984	ITALY	UNCL	1250		1
1984	ITALY	SPOR	10		1
1984	ITALY	TRAP	327		1
1984	ITALY	PS	1913		1
1984	ITALY	LLHB	41		1
1984	JAPAN	LLHB	1036	763	2
1984	LIBYA	UNCL	300		1
1984	MALTA	UNCL	21		1
1984	MAROC	SURF	4		1
1984	TUNISIE	TRAP	80		1
1984	TURKEY	UNCL	869		1
1984	YUGOSLAV	PS	825		1
RAISED FROM SAMPLE			9743	7407	
SUBSTITUTED			7609		
TOTAL			17352		

DATA SOURCE:

- 1 = SIZE DATA WERE SUBSTITUTED
- 2 = DATA ARE RAISED USING SAMPLES FROM THE SAME FISHERY
- 3 = 100% SAMPLE

Table 3. Continued...

YEAR	COUNTRY	GEAR	CATCH	# FISH	SOURCE
1985	ALGERIE	UNCL	260	1	
1985	ESPANA	GILL	2	1	
1985	ESPANA	HAND	267	2	
1985	ESPANA	BB	278	2	
1985	ESPANA	UNCL	22	1	
1985	ESPANA	SURF	415	2	
1985	ESPANA	TRAP	302	2	
1985	ESPANA	PS	56	2	
1985	ESPANA	LLHB	129	2	
1985	FRANCE	PSM	5400	2	
1985	FRANCE	SPOR	30	1	
1985	GREECE	UNCL	500	1	
1985	ITALY	PSFS	2329	1	
1985	ITALY	PSFB	1453	2	2458
1985	ITALY	GILL	100	1	
1985	ITALY	HAND	10	1	
1985	ITALY	UNCL	2100	1	
1985	ITALY	SPOR	50	1	
1985	ITALY	TRAP	295	1	
1985	ITALY	PS	740	1	
1985	ITALY	LLHB	62	1	
1985	JAPAN	LLHB	873	2	2568
1985	LIBYA	UNCL	300	1	
1985	MALTA	UNCL	21	1	
1985	MAROC	SURF	12	1	
1985	TUNISIE	TRAP	80	1	
1985	TURKEY	PS	2230	1	
1985	YUGOSLAV	PS	1010	1	
RAISED BY SAMPLE			9173	5026	
SUBSTITUTED			10153		
TOTAL			19326		
1986	ALGERIE	UNCL	566	1	
1986	ESPANA	HAND	29	2	126
1986	ESPANA	SURF	220	2	
1986	ESPANA	TRAP	168	1	
1986	ESPANA	PS	22	1	
1986	ESPANA	LLHB	117	2	1453
1986	FRANCE	PSM	3460	2	
1986	FRANCE	SPOR	30	1	
1986	GREECE	UNCL	125	1	
1986	ITALY	PSFS	2207	1	
1986	ITALY	PSFB	1082	2	1513
1986	ITALY	GILL	45	1	
1986	ITALY	UNCL	2338	1	
1986	ITALY	SPOR	50	1	
1986	ITALY	TRAP	293	1	
1986	ITALY	PS	1500	1	
1986	ITALY	LLHB	1	1	
1986	JAPAN	LLHB	421	2	761
1986	LIBYA	UNCL	300	1	
1986	MALTA	UNCL	41	1	
1986	MAROC	SURF	18	1	
1986	TUNISIE	TRAP	84	1	
1986	TURKEY	PS	1524	1	
1986	YUGOSLAV	PS	757	1	
RAISED BY SAMPLE			5329	3853	
SUBSTITUTED			10069		
TOTAL			15398		

DATA SOURCE:

- 1 = SIZE DATA WERE SUBSTITUTED
- 2 = DATA ARE RAISED USING SAMPLES FROM THE SAME FISHERY
- 3 = 100% SAMPLE

YEAR	COUNTRY	GEAR	CATCH	#FISH	SOURCE
1987	ALGERIE	UNCL	420		1
1987	ESPANA	HAND	177	411	2
1987	ESPANA	SURF	404		2
1987	ESPANA	TRAP	219	332	2
1987	ESPANA	LLHB	116	398	2
1987	FRANCE	PSM	4300		2
1987	FRANCE	SPOR	30		1
1987	GREECE	UNCL	100		1
1987	ITALY	PSFS	522		1
1987	ITALY	PSFB	557	851	2
1987	ITALY	UNCL	1495		1
1987	ITALY	SPOR	53		1
1987	ITALY	TRAP	310		1
1987	ITALY	PS	1500		1
1987	ITALY	LLHB	65		1
1987	JAPAN	LLHB	280		2
1987	LIBYA	UNCL	300		1
1987	MALTA	UNCL	36		1
1987	TUNISIE	TRAP	83		1
1987	TURKEY	PS	910		1
1987	YUGOSLAV	PS	641		1
RAISED BY SAMPLE			6053	1992	
SUBSTITUTED			6465		
TOTAL			12518		
1988	ALGERIE	UNCL	677		1
1988	ESPANA	TRAP	201	333	2
1988	ESPANA	LLHB	136	761	2
1988	ESPANA	HAND	553	1458	2
1988	ESPANA	SURF	225		1
1988	FRANCE	PSM	5750		2
1988	FRANCE	SPORT	30		1
1988	GREECE	UNCL	100		1
1988	ITALY	PSFS	395		1
1988	ITALY	PSFB	334	395	2
1988	ITALY	UNCL	1452		1
1988	ITALY	SPOR	51		1
1988	ITALY	TRAP	301		1
1988	ITALY	PS	1500		1
1988	ITALY	LLHB	63		1
1988	JAPAN	LL	250		1
1988	LIBYA	UNCL	300		1
1988	MALTA	UNCL	25		1
1988	MAROC	SURF	44		1
1988	MAROC	TRAP	96		1
1988	TUNISIE	TRAP	83		1
1988	TURKEY	PS	910	86	2
1988	YUGOSLAV	PS	1512		1
RAISED BY SAMPLE			7884	3033	
SUBSTITUTED			7104		
TOTAL			14988		

Table 4. Summary of bluefin sampling and substitution levels

YEAR	AREA	TOTAL CATCH MT	SIZE SAMPLES AVAILABLE MT	%	# FISH MEASURED*	SUBSTI- TUTED MT	# FISH PER CATCH(MT)
1984	EAST	7386	6402	86.7%	2370	984	0.32
	MED	17352	9743	56.1%	7407	7609	0.43
	WEST	2499	2282	91.3%	2171	217	0.87
1985	EAST	4754	4062	85.4%	768	692	0.16
	MED	19326	9173	47.5%	5026	10153	0.26
	WEST	5414	2658	49.1%	7356	2756	1.36
1986	EAST	4292	3790	88.3%	3153	502	0.73
	MED	15398	5329	34.6%	3853	10069	0.25
	WEST	1917	1799	93.8%	7747	118	4.04
1987	EAST	4536	3437	75.8%	4175	1099	0.92
	MED	12518	6053	48.4%	1992	6465	0.16
	WEST	2602	2395	92.0%	3105	207	1.19
1988	EAST	4944	4609	93.2%	5932	335	1.20
	MED	14988	7884	52.6%	3033	7104	0.20
	WEST	2986	2782	93.2%	3417	204	1.14

* The number of fish measured can be very underestimated, as information for some countries is not always available.

TABLE 5. Sampling level of swordfish in the Mediterranean Sea

YEAR	TOTAL CATCH MT	SAMPLED CATCH MT	SAMPLES WEIGHT KG	No	UNSAMPLED CATCH MT	SAMPLED CATCH %
78	5460	722	9346	198	4738	13.2
79	5110	803	10836	236	4307	15.7
80	5383	751	35413	578	4632	14.0
81	5712	1121	??	563	4591	19.6
82	5409	905	??	1463	4504	16.7
83	5951	6	6923	70	5945	0.1
84	11766	1262	307924	12785	10504	10.7
85	13210	1233	??	??	11977	9.3
86	15335	3668	??	1218+	11667	23.9
87	16309	1490	??	1106	14819	9.1
88	18259	1760	??	??	16499	9.6

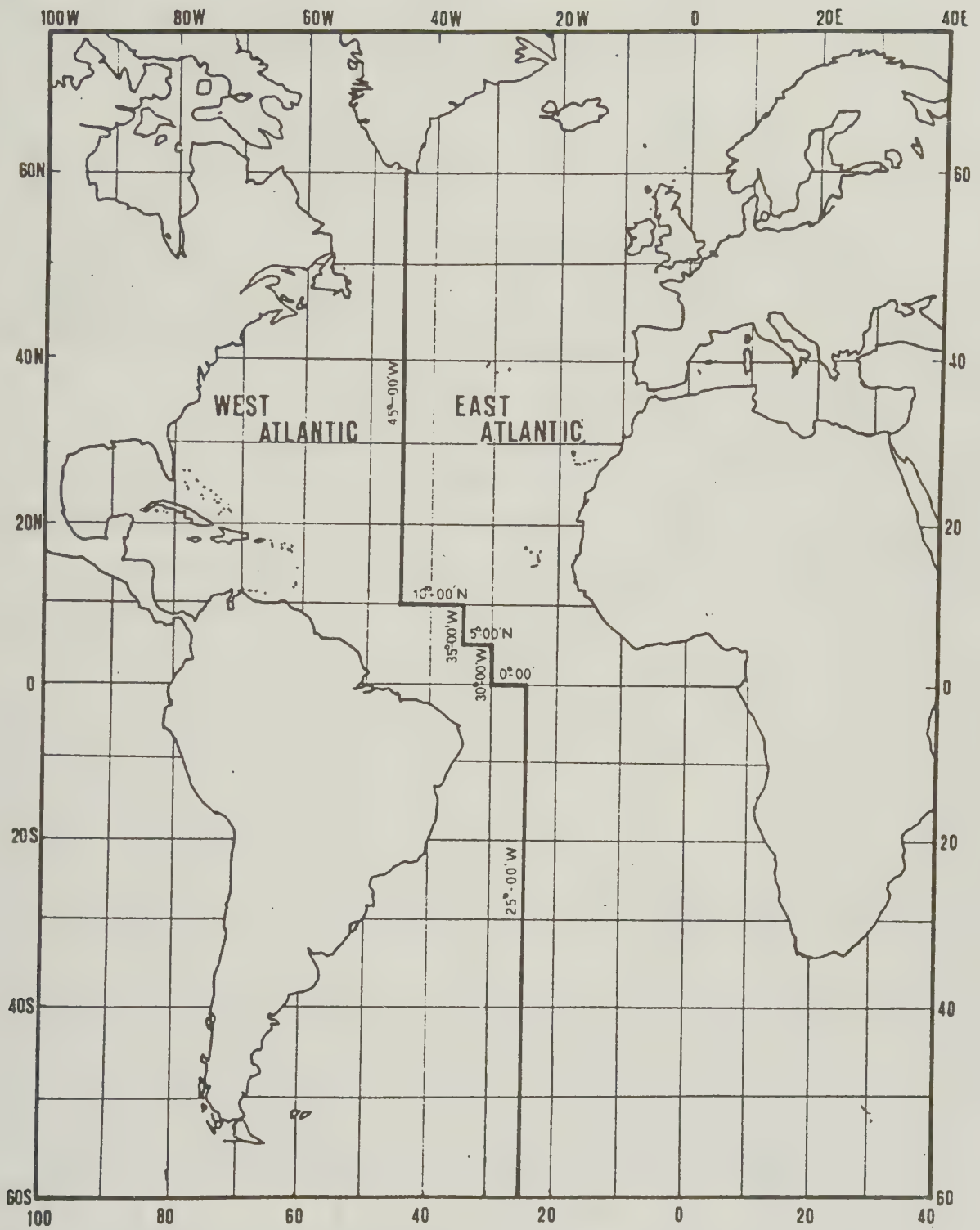


Fig. 1. Division line between East and West Atlantic stocks

Fig. 2 - Swordfish areas agreed upon by Workshop members for initial data preparation

PECHERIE THONIERE DANS LA MEDITERRANEE MAROCAINE

par

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Abstract

Tunas migrate from the Atlantic to the Mediterranean in April/June and from the Mediterranean to the Atlantic in September/November. They are generally caught during these two seasons. There are two fishing zones on the Mediterranean coast of Morocco: the Strait of Gibraltar and the area situated between Hoceima and Saidia.

Tunas are fished by the artisanal fishermen (1 605 tons in 1989) by fixed nets called madragues (365 tons in 1989). The production of tunas has increased between 1987 and 1989; more fishing units and madragues are expected for the near future.

I. INTRODUCTION.

Bien que les apports des thonidés soient relativement faibles dans les débarquements globaux de la Méditerranée, ils suscitent cependant, un intérêt particulier par leur valeur commerciale assez importante et par leur pouvoir hautement migratoire qui fait des côtes marocaines une zone de passage de ces espèces.

Cette note préliminaire vise à élucider certains aspects afférents à l'exploitation de cette pêcherie comme l'évolution des débarquements et, la définition des espèces pêchées, des techniques de pêche utilisées et des zones et saisons de pêche.

Les données de base sont issues des statistiques de la pêche côtière collectées au niveau des halles aux poissons et au niveau des Délégations Régionales du Ministère des Pêches Maritimes et de la Marine Marchande pour les données concernant les madragues. Il convient de signaler qu'aucune donnée biologique n'est signalée dans ce rapport vue que le réseau d'échantillonnage biologique de l'Institut des Pêches ne couvre pas encore ces espèces. Les prises par type de pêche ne sont également relevés sauf pour les madragues.

II. CARACTERISTIQUES DE LA PECHERIE.

Pour des raisons génétiques et trophiques, les thonidés effectuent une migration de l'Atlantique vers la Méditerranée durant une première période avril-juin; une deuxième migration s'effectue dans le sens inverse en septembre-novembre. Ces migrations expliquent en fait, le caractère saisonnier de cette pêcherie se traduisant par des maximum de production durant les deux périodes de passage de ces espèces.

Les espèces de thonidés rencontrées dans la côte méditerranéenne du Maroc sont au nombre de six.

Nom vernaculaire	Nom scientifique	Code ICCAT
-----	-----	-----
Bonite sarda (Sarda)	Sarda sarda	BON
Espadon	Xiphius gladius	SWO
Melva	Auxis thazard	FRI
Palomette	Orcynopsis unicolor	BOP
Thon rouge	Thunnus thynnus thynnus	BFT
Bacorette	Euthynnus alletteratus	LTA

Actuellement, les thonidés sont capturés principalement par quatre type de pêche:

- Senneurs: ces unités d'une longueur moyenne de 15 m et d'un tjb de 40 capturent comme prises accessoires de la bonite, du melva, et rarement de l'espadon et du thon rouge. L'engin utilisé est la senne coulissante.

- Palangriers: ce sont de petites embarcations de 3 tjb en moyenne. La plus part de ces unités se donnent par saison à la pêche des thonidés en utilisant le filet maillant (bonitard) ou la palangre dérivante. Le nombre de ces unités est estimé à 30. Les espèces capturées par ces unités sont surtout l'espadon et le thon rouge pour la palangre et, la bonite et le melva pour le filet maillant.

- Pêche artisanale: c'est une pêche aux petits métiers (unités de 5 mètres) pratiquée le long des côtes de la méditerranée. Elle utilise différents types d'engins comme la canne, le filet maillant, le tremail et le bonitard. Les prises de thonidés effectuées par cette pêche ne sont pas encore bien cernées.

- Madrague: c'est un engin de pêche fixe calé perpendiculairement à la côte pendant la saison de pêche des thonidés. Il existe actuellement une seule madrague en méditerranée capturant surtout le thon rouge et le melva. Deux autres madragues sont en cours d'implantation.

Il est à signaler que les chalutiers capturent accidentellement des thonidés mais en très faibles quantités.

La zone de pêche des thonidés se concentre dans le parage du détroit de Gibraltar et dans la zone comprise entre El Hoceima et Saidia.

III. DEBARQUEMENTS DES THONIDES DE LA MEDITERRANEE.

On distingue dans ce volet les débarquements réalisés par la flottille côtière et les captures de la madrague.

3.1 Pêche côtière.

Une série historique des captures par espèce a été élaborée pour les dix dernières années (Tableau 1 et Figure 2). On constate une diminution en 1982, une stabilisation entre 1982 et 1987 puis une nette reprise à partir de 1987. L'augmentation de la capture totale des thonidés est dû à une augmentation importante de la pêche de melva. La capture du thon rouge a également augmenté entre 1987 et 1989.

Durant l'année 1989, 1605 T de thonidés et espèces voisines ont été débarqués dans les ports de la méditerranée marocaine contre 1133 T pour l'année précédente soit une augmentation de 42 % environ.

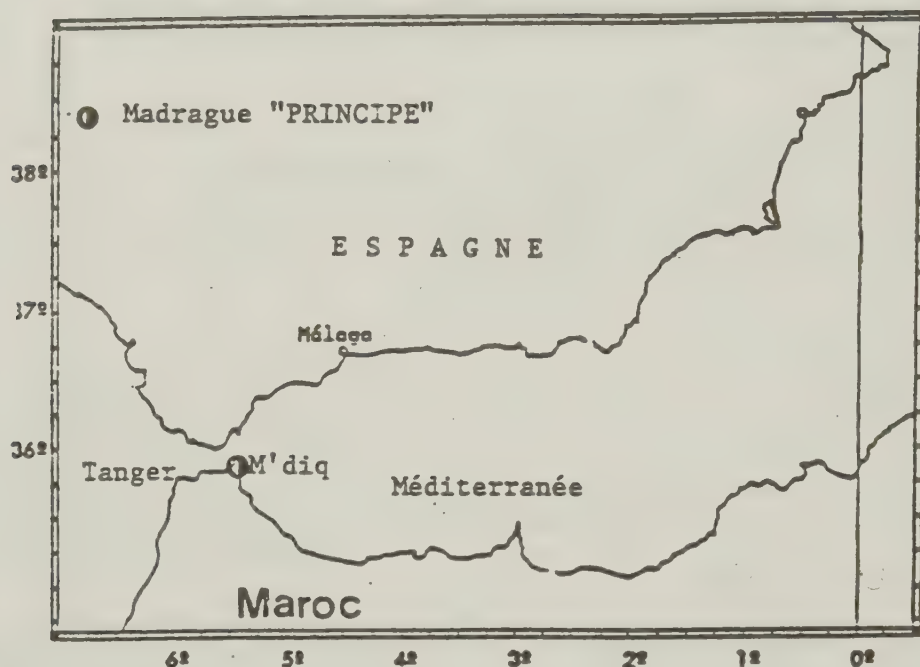
L'examen de la Figure 3 montre que le melva constitue l'espèce la plus dominante dans les captures. Le thon et l'espadon viennent respectivement en deuxième et troisième rang.

Le tableau 3 et la Figure 4 dresse les captures par port. Les apports réalisés en 1989 au port d'El Hoceima, sont de loin les plus importants.

3.2 Madrague.

La madrague "PRINCIPE" constitue la seule madrague opérationnelle dans la méditerranée marocaine. Elle est calée à proximité du M'diq (35 49'N et 5 17'W) (voir Figure 1). L'activité de cette madrague s'étale en général, du mois de juillet au mois de janvier.

Fig. 1. Localisation de la madrague "PRINCIPE"



La madrague "PRINCIPE" a commencé ces activités depuis 1956. Le niveau de production était de 1140 T en moyenne pour les cinq premières années (Tableau 2 et Figure 5). Depuis 1960, on a assisté à une chute progressive des rendements jusqu'à atteindre les niveaux les plus bas de la production entre 1971 et 1979. La madrague s'est arrêté en 1980 pour reprendre en 1986.

L'effort de pêche a été relevé pour les quatre dernières années. La Figure 6 montre une faible variation de l'effort de pêche et une augmentation croissante de la CPUE.

Pendant l'année 1989, la capture de la madrague "PRINCIPE" est de 356 T dont 286 T du thon rouge (N=2111) et 70 T du melva (N=70130). Le poids moyen individuel se situe à 135 kg pour le thon rouge et à 1 kg pour le melva (Tableau 4). Comparés aux poids moyen de ces espèces dans les côtes méditerranéennes espagnoles, ces valeurs sont presque identiques.

IV. CONCLUSION

La pêche thonière dans la méditerranée fait l'objet d'une exploitation saisonnière par la flottille côtière et par une madrague. La production a nettement augmenté entre 1987 et 1989 aussi bien pour les unités de pêche que pour la madrague. Ces éléments seraient des indices d'un développement éventuel que pourrait connaître cette pêche surtout si l'on sait qu'au moins trois madragues vont être implantées cette année dans les côtes marocaines.

Ce rapport constitue une étape de base pour diriger de plus amples études. Le programme d'échantillonnage biologique des thonidés prévu cette année contribuera sûrement à l'amélioration des connaissances sur la pêche thonière en Méditerranée occidentale.

Fig. 2. Evolution des captures de thonidés en Méditerranée durant la période 1980-1989.

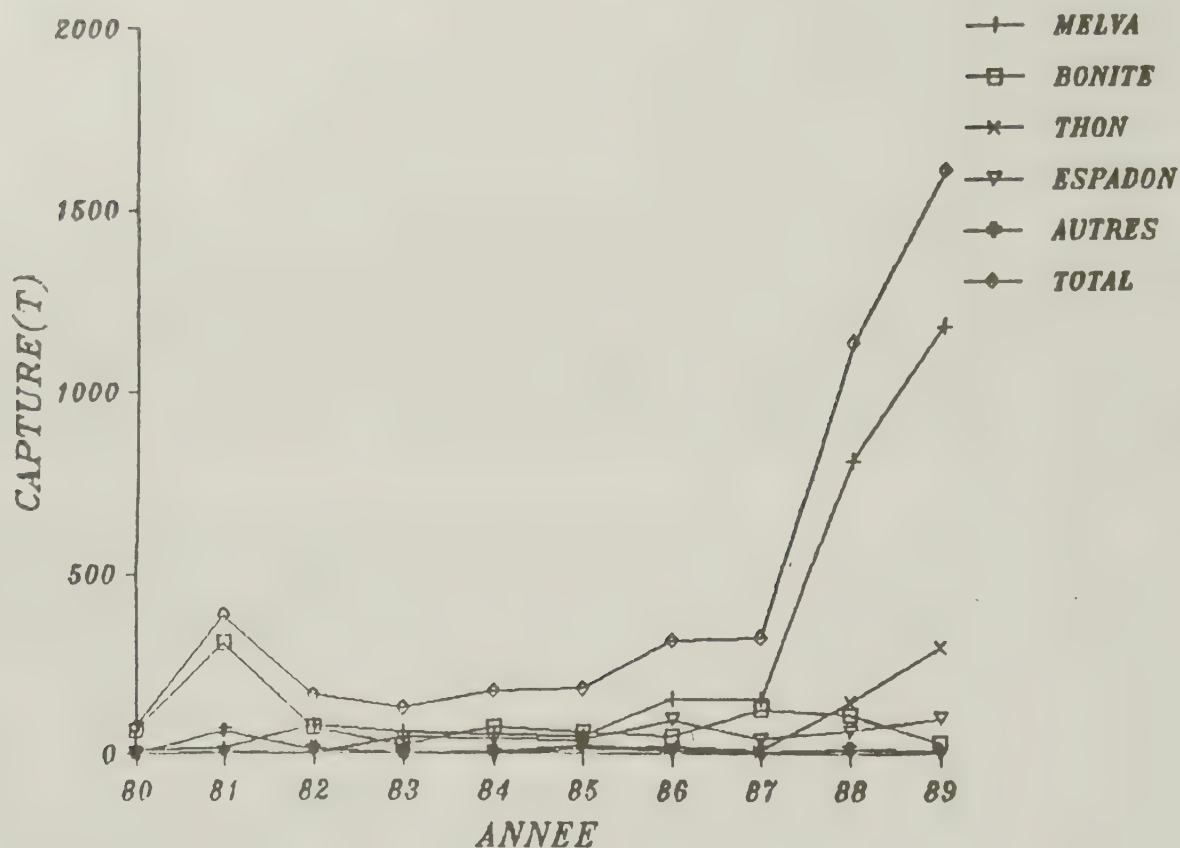
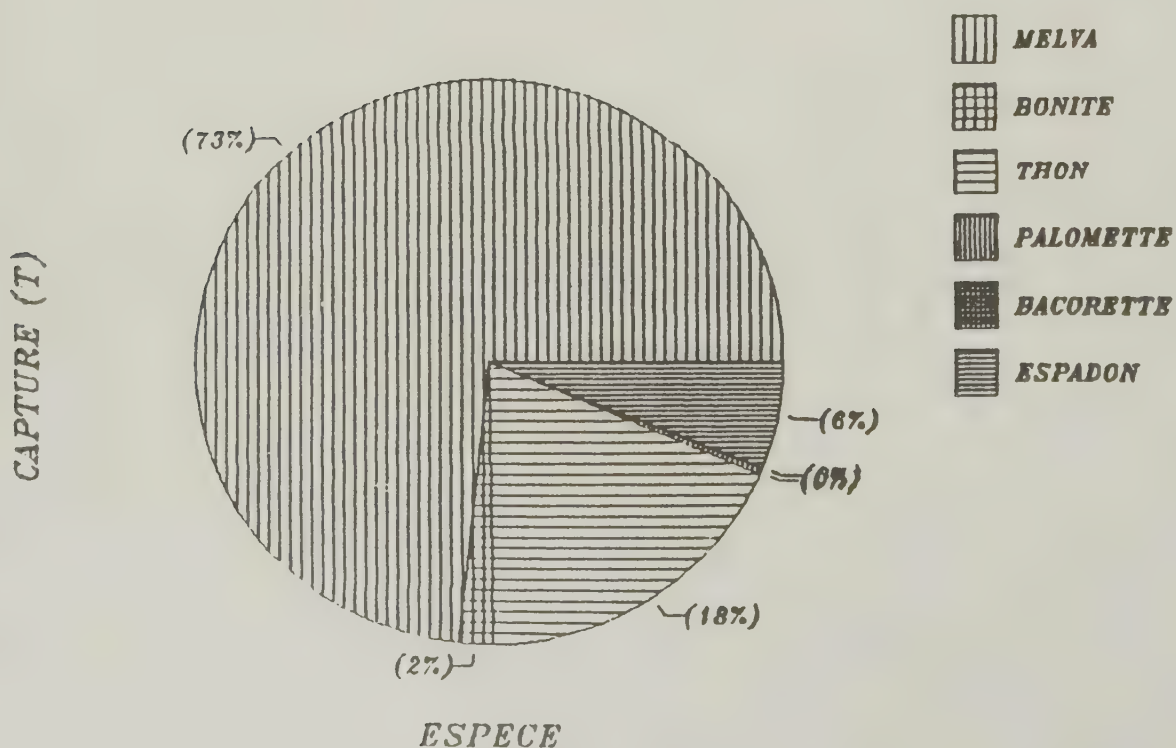


Fig. 3. Composition en espèces des thonidés capturés en Méditerranée pour l'année 1989.



Tabl. 1. Captures (T) des thonidés de la Méditerranée
durant la période 1980-1989.

	1980	81	82	83	84	85	86	87	88	89
MELVA	10	14	77	57	52	48	150	151	811	1177
LISTAD	0	0	0	1	0	13	7	2	0	0
BONITE	62	309	71	22	74	57	47	122	107	28
THON	0	2	0	1	4	12	18	6	140	295
PALONETTE	0	0	0	0	1	10	1	3	0	7
BACORETTE	0	62	12	0	2	0	0	0	12	0
ESPADON	0	0	0	43	39	38	92	40	62	97
TOTAL	72	384	160	124	172	178	315	324	1133	1605

Fig. 4. Production des thonidés (T) dans les différents
ports de la Méditerranée (1989).

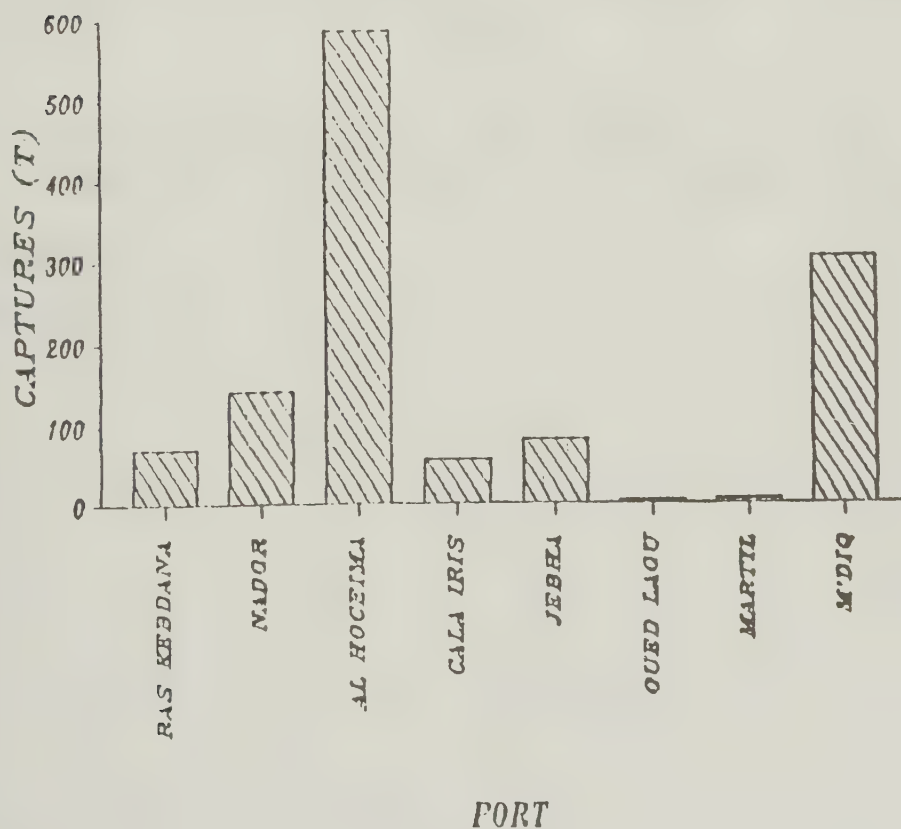


Fig. 5. Evolution des captures (T) de la madrague "PRINCIPE" durant la période 1956-1989.

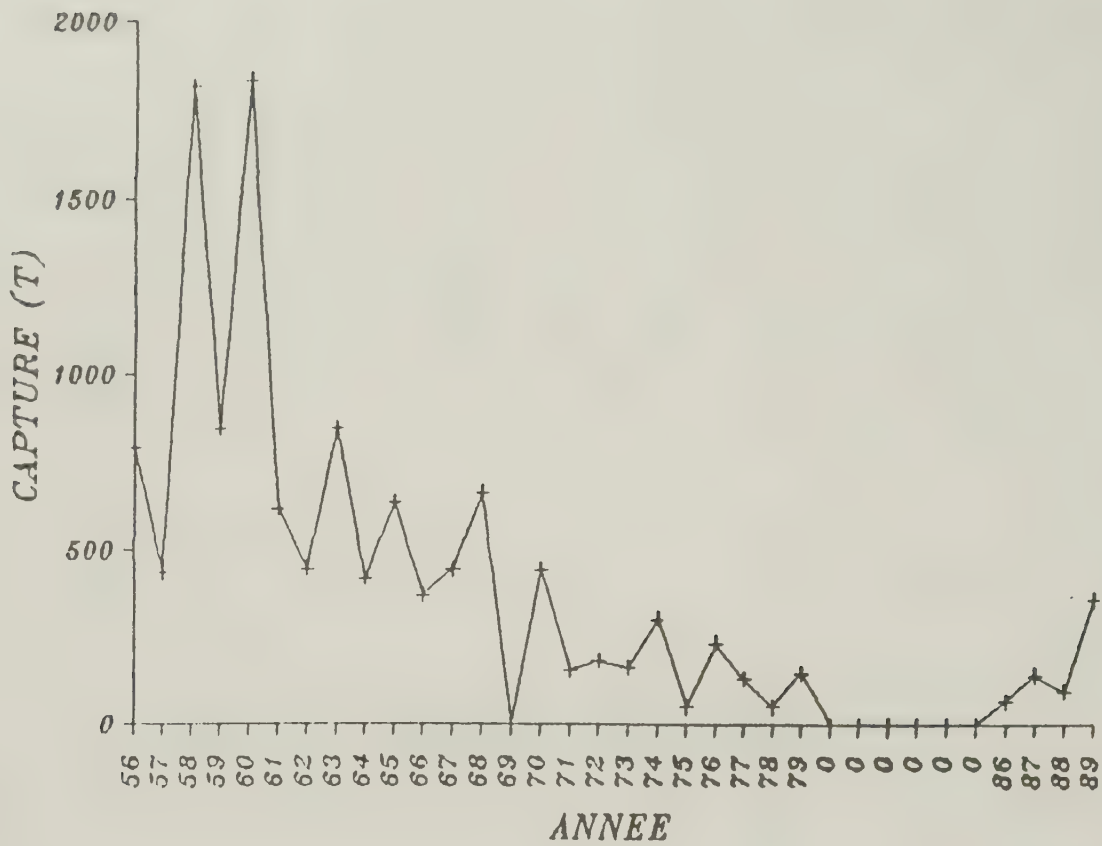
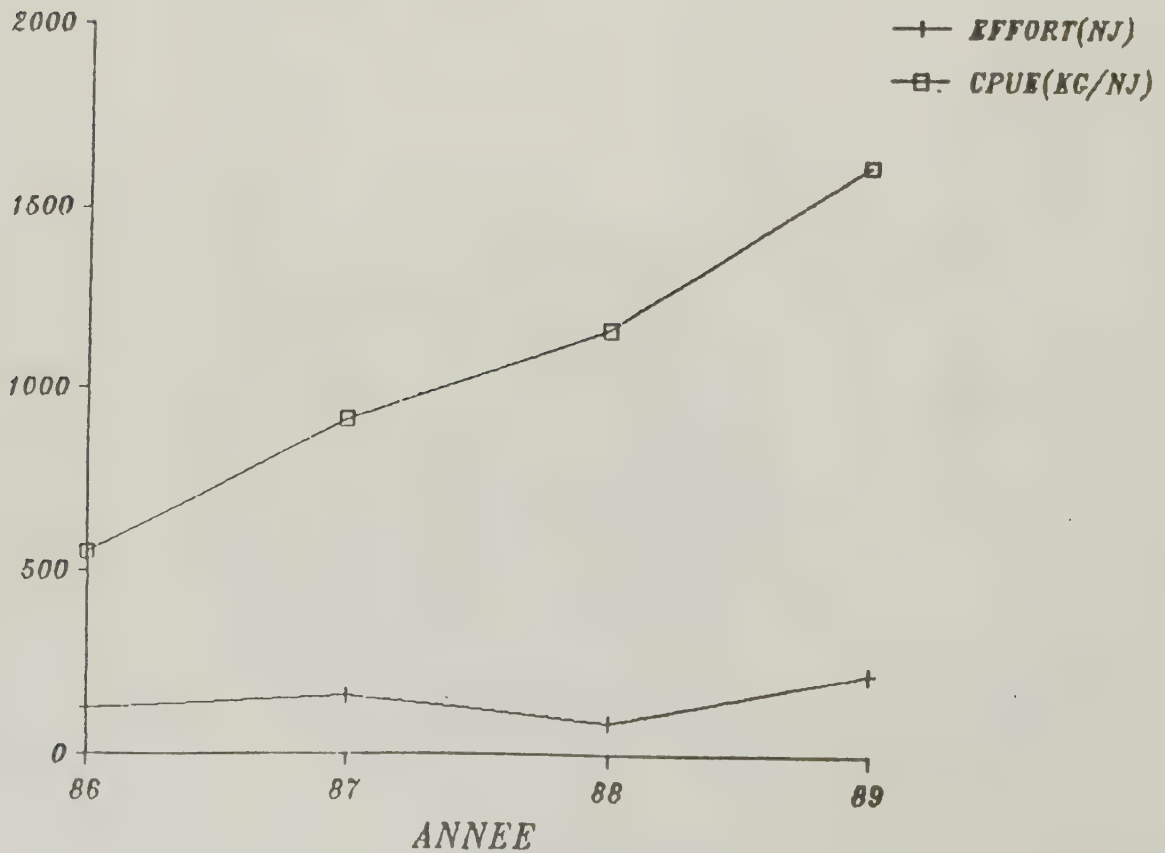


Fig. 6. Evolution de l'effort (MJ) et de la CPUE des thonidés de la madrague "PRINCIPE" pour les quatre dernières années 1986 - 1989.



Tabl. 2. Captures (T) des thonidés de la madrague "PRINCIPE" durant la période 1986 _ 1989

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	ARR.	1986	1987	1988	1989
CAPTURE (T)	793	435	1814	846	1831	618	445	846	418	637	370	443	665	0	444	156	182	163	301	52	233	134	52	148		68	142	97	356
EFFORT (NJ)																										123	154	83	219
PERIODE																										17-11	16-11	6-8	16-01
C P U E																										0.55	0.91	1.16	1.63

Tabl. 3. Captures (Kgs) des thonidés dans les ports de la Méditerranée pour l'année 1989

	IPAS	VERDONIA	NADOR	AL	HOCEIMA	CALA	IRIS	JERMA	OUED	LAOU	MARTIL	M'DIO	TOTAL
IRACORETTE	380	80					0	0	0	0	0	30	490
ICRUIE SARDIA	1545	4725	1890		0	510				0	700	18550	27920
IESPADON	19056	73054	4950								0	185	97245
ILISTAO		0									0	0	0
IMEI VA	44091	59215	579300		56270	81810			320	3700	202040	1106746	
IFALONNETTE	3640	0			0	0			0	0	0	3870	6910
ITHON	1549	4004	570		0	0			2610	0	0	535	9268
TOTAL	69661	141078	586710		56270	82320			2930	4400	305210	1248579	

Tabl. 4. Poids moyen (kg/individu) des thonidés capturés par la madrague "PRINCIPE" en 1989.

	:POIDS	:EFFECTIF:P.MOYEN:
:THON	: 285706 :	: 2111 : 135 :
:MELVA	: 70222 :	: 70130 : 1 :
:T O T A L :	: 355928 :	: 72241 :

GENERAL FISHERIES COUNCIL FOR THE MEDITERRANEAN
INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS
EXPERT CONSULTATION ON THE EVALUATION OF
STOCKS OF LARGE PELAGIC FISHES IN THE MEDITERRANEAN AREA

Bari, Italy 21-27 June 1990

TRONCONE A., MARANO G., MARCOTRIGIANO G.O.,
ROSITANI L. and ZIZZO N.

THE STRANDING OF CETACEANS ALONG THE COASTS OF PUGLIA:
CONNECTIONS WITH FISHING

INTRODUCTION

The increasing eutrophication of the Mediterranean waters, and of the Adriatic in particular, suggests the setting up of research projects and of monitoring to assess the fluctuations in the characteristics of the waters and their degeneration and pollution rates.

The Regional Authorities in Puglia and in particular the Ecology Department have contributed to this study of the changes in the coastal marine habitat, also setting up a survey and census of the stranding of cetaceans on the coasts of Puglia on the basis of a mortality phenomenon mainly evident in the Salentine peninsula.

The Puglia Regional Ecology Department ruled (N. 3705 - 16.04.87) the setting up of a Regional Commission. An information was set up with the collaboration of the Port Authorities, the Police Force, the Local Veterinary Services and other institutions.

When there are cases of stranding, experts are sent on the spot to collect data on the species, sex, size and damage, etc. When the state of conservation of the animal permit, transport is arranged to a collection centre supplied with cold cells. A necroscopic exam is carried out at once and samples of the various parts are taken to then carry out anatomo-histopathologic investigations, chemical analysis and other biological, microbiological and parasitological investigations to establish the possible causes of mortality.

The data collected are relayed to the Centro Studi Cetacei (an institution conducting a survey on stranding along all the Italian coasts) with which there is a reciprocal exchange of information

so as to obtain more complete information over the entire Mediterranean area.

Data for stranding in the period April 87 - April 90

In the period April 87 to April 90, 85 cetaceans were stranded on the coasts of Puglia. Part of the data collected are reported in the referred list, in particular the species, the sex, the locality and date of stranding, the length and destination of the carcass. It should be pointed out that it was not always possible to carry out accurate observations on the animals stranded because of delays in communication so that putrefaction had already set in.

On necroscopic examination 15 specimen showed solutions of continuity on the skin which may have been caused by fishing action. On some of these it was only possible to carry out superficial macroscopic observation or to examine the single organs or tissues in a reasonably good state.

Evident traumatic lesions such as amputation of the caudal fin were also observed (N. 2 Tursiops truncatus, 1 Stenella coeruleoalba and 2 undetermined dolphins) on some of these specimens, in (N. 1 Tursiops truncatus) various superficial grazes were evident which may be attributed to fishing tackle; a Tursiops truncatus in an advanced state of decomposition presenting a coil of fishing line in its mouth was inspected.

Necroscopic examinations of the cetaceans in a reasonable state were carried out and 6 of these presented various solutions of continuity.

1) Tursiops truncatus stranded at Monopoli (BA) on 21.03.88

External examination showed irregular solutions of continuity of various size all over the skin penetrating under the skin. The caudal fin was missing as a result of a sharp cut presenting edges with medium inflammation.

2) Grampus griseus stranded in the Mar Grande in Taranto on 02.06.88

External examination did not show any alteration. On dissection when examining the mouth orifice apparatus a number of nylon lines were found, one of which with relative hook for sword fish stuck in the pharynx; three other hooks were in the mechanical stomach.

3) Tursiops truncatus stranded at Pilone beach, Ostuni (BR) on 11.03.90

In an advanced state of putrefaction. Two wounds were observed in the right thorax region. They were round in shape, the size of a small coin, with clean cut edges. These wounds penetrated under the skin down to the muscle and reaching the region of the thorax. One extended to the pericardium and the superior right heart

causing death.

4) S.c. stranded at S. Pietro in Bevagna (TA) on 27.03.90

5) S.c. stranded at Marina di Leporano (TA) on 04.04.90

External examination of both revealed solutions of continuity all over the body down to the underlying skin. These were typical marks caused by nets, straight, thin, proceeding irregularly. Lung congestion, the presence of foam in the trachea, exhaustion and myocardium degeneration point to cardio-circulatory collapse as cause of death.

6) Stenella coeruleoalba stranded at Trani (BA) on 06.11.87

On skinning this specimen presented a sero hemorrhagic liquid under the skin and in the muscle tissue in the area of the melon giving the muscle a mushy aspect. Clearly of traumatic origin, this damage extended to the cranial bone which was fractured. A hematoma was evident in the left cerebral hemisphere of the cranial cavity; also the left upper and lower jaw bones were fractured.

Conclusions

Research carried out on cetaceans stranded (N. 85) show that the causes of mortality may be attributed to various factors and mainly to lung congestion, myocardium serious malfunctioning, general toxic situation; parassitosis and traumatic factors.

The presence of PCBs was found in all the specimen examined as well as organo-chlorurate pesticides with variable concentrations according to the tissues and organs involved but never in sufficient quantities to cause death.

Similar considerations may be drawn for the heavy metals and in particular for mercury, lead and cadmium. Only 3 specimens showed a chromium high concentration at liver and dorsal muscle.

On 13 specimens (S. coeruleoalba, T. truncatus and G. griseus) it was possible to see lesions, the result of fishing action (nets and long-lines) triggering pathologies leading to death.

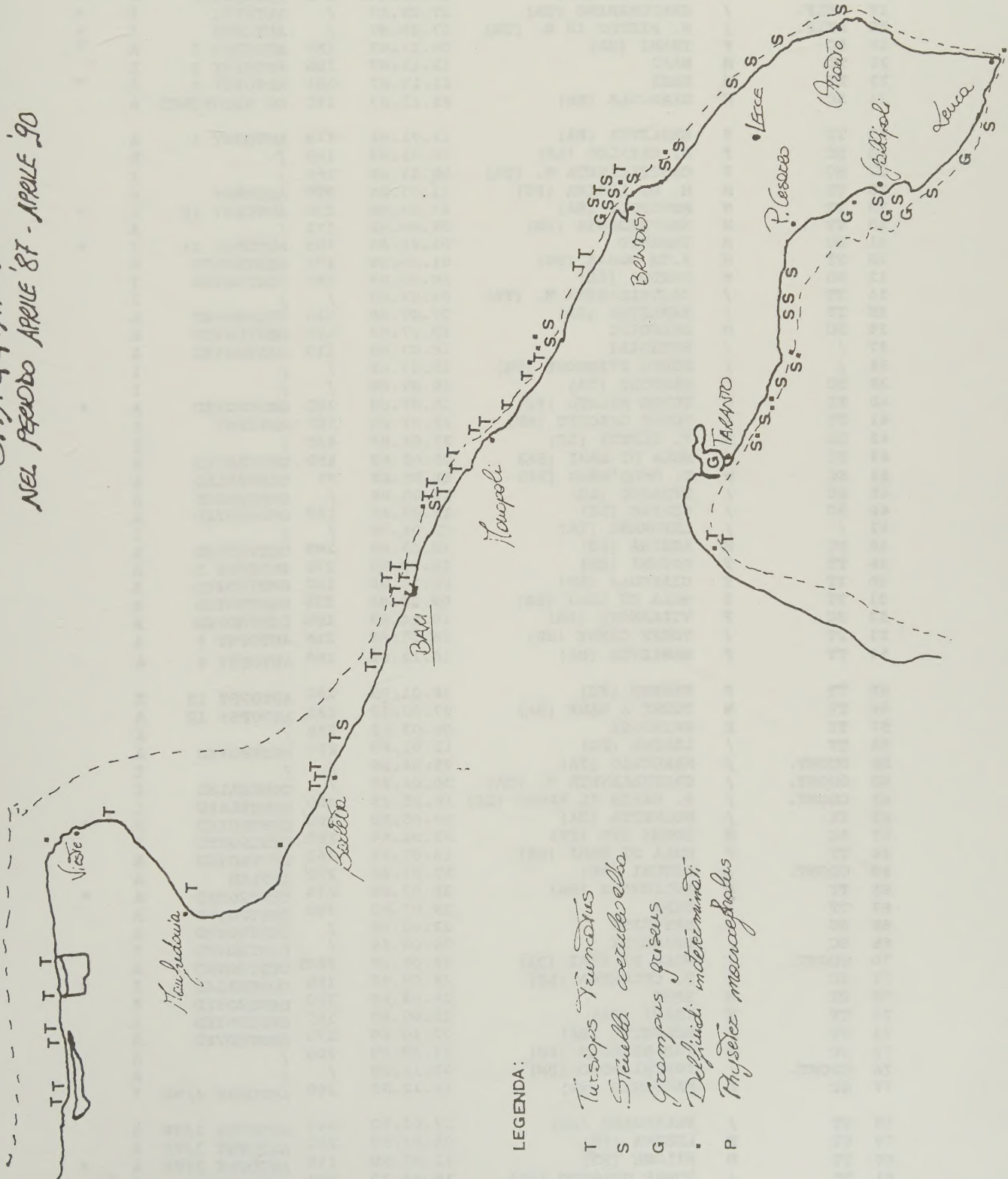
These preliminary data to be completed and elaborated demonstrate that different fishing activities significantly influence (15,2%) the mortality rate of dolphins along the coasts of Puglia and this data, together with those from other areas of the Mediterranean point out the need to review the selectivity of fishing gears, especially those used for the catch of large pelagic.

However, in order to obtain significative data of statistic relevance, this research should be continued in the future to provide data on the influence of commercial fishing and other phenomena and to gain more information concerning the selectivity

of fishing equipment.

In this way it would be possible to set up a plan for the rational management of fishing resources protecting at the same time the marine vertebrates (cetaceans and turtles) of no fishing importance.

SPIAGGIAMENTI
NEL PERIODO APRILE '87 - APRILE '90



1	SC	/	GALLIPOLI (LE)	01.04.87	/	NO RECOVERED	I	
2	SC	M	TAVIANO (LE)	04.04.87	201	AUTOPSY	I	
3	SC	/	OSTUNI (BR)	10.04.87	/	/	A	
4	SC	M	MANDURIA (TA)	11.04.87	200	AUTOPSY	I	
5	SC	F	MOLA DI BARI (BA)	14.04.87	165	AUTOPSY 1	A	
6	SC	F	GALLIPOLI (LE)	25.04.87	163	AUTOPSY	I	
7	SC	M	S. FOCA (LE)	29.04.87	/	NO RECOVERED	A	
8	TT	/	MOLA DI BARI (BA)	11.05.87	320	DESTROYED	A	
9	DELF.	/	OSTUNI (BR)	11.05.87	/	BURIED	A	
10	DELF.	/	OSTUNI (BR)	14.05.87	/	DESTROYED	A	
11	GG	/	S. GENNARO (BR)	06.06.87	300	NO RECOVERED	A	
12	SC	F	M. DI PULSANO (TA)	07.06.87	170	BURIED	I	
13	TT	F	MONOPOLI (BA)	24.06.87	280	DESTROYED	A	
14	SC	/	T. PALI (LE)	18.07.87	/	NO RECOVERED	A	
15	GG	/	FELLINE (LE)	19.07.87	125	CONGEALED	I	
16	DELF.	M	PESCHICI (FG)	04.08.87	200	BURIED	A	
17	DELF.	/	ZAPPONETA (FG)	19.08.87	/	BURIED	A	
18	TT	M	CAPITOLO (BA)	10.09.87	245	DESTROYED	A	*
19	DELF.	/	CAMPOMARINO (TA)	27.09.87	/	AUTOPSY	I	*
20	DELF.	/	S. PIETRO IN B. (TA)	27.09.87	/	AUTOPSY	I	*
21	SC	F	TRANI (BA)	06.11.87	155	AUTOPSY 7	A	*
22	TT	M	BARI	12.12.87	186	AUTOPSY 2	A	
23	TT	M	BARI	21.12.87	201	AUTOPSY 3	A	
24	SC	M	GIANCOLA (BR)	23.12.87	142	NO RECOVERED	A	
25	TT	F	BARLETTA (BA)	17.01.88	179	AUTOPSY 4	A	
26	SC	F	S. CATALDO (LE)	24.01.88	180	/	A	
27	SC	F	CASTELLANETA M. (TA)	08.03.88	110	/	I	
28	TT	M	M. DI LESINA (FG)	11.03.88	230	AUTOPSY	A	
29	TT	M	MONOPOLI (BA)	21.03.88	230	AUTOPSY 10	A	*
30	TT	M	MANFREDONIA (FG)	02.06.88	271	/	A	
31	GG	M	TARANTO	02.06.88	255	AUTOPSY 14	I	*
32	TT	M	P.TA ROSSA (FG)	04.06.88	271	DESTROYED	A	
33	GG	M	NARDO' (LE)	26.06.88	350	DESTROYED	I	
34	TT	/	CASTELLANETA M. (TA)	03.07.88	/	/	I	
35	TT	/	BARLETTA (BA)	07.07.88	310	PRESERVED	A	
36	SC	M	BRINDISI	13.07.88	130	DESTROYED	A	
37	/	/	BRINDISI	18.07.88	110	DESTROYED	A	
38	/	/	PORTO PIERRONE (TA)	19.07.88	/	/	I	
39	SC	/	GANDOLI (TA)	19.07.88	/	/	I	
40	TT	M	TORRE MILETO (FG)	19.07.88	260	DESTROYED	A	*
41	TT	F	TORRE GUACETO (BR)	27.07.88	283	AUTOPSY	A	
42	GG	M	T. ULUZZI (LE)	27.06.88	420	/	I	
43	TT	/	MOLA DI BARI (BA)	02.08.88	150	DESTROYED	A	
44	SC	M	T. DELL'ORSO (LE)	11.08.88	92	CONGEALED	A	
45	SC	/	OTRANTO (LE)	16.08.88	/	CONGEALED	A	
46	SC	/	CESINE (LE)	19.08.88	120	DESTROYED	A	
47	/	/	LEPORANO (TA)	23.08.88	/	/	I	
48	TT	M	LESINA (FG)	10.09.88	305	DESTROYED	A	
49	TT	F	OSTUNI (BR)	26.09.88	270	AUTOPSY 5	A	
50	TT	F	GIANCOLA (BR)	08.10.88	180	DESTROYED	A	
51	TT	F	MOLA DI BARI (BA)	09.10.88	335	DESTROYED	A	
52	SC	F	VILLANOVA (BR)	10.11.88	190	DESTROYED	A	
53	TT	/	TORRE CANNE (BR)	26.11.88	216	AUTOPSY 9	A	
54	TT	F	BARLETTA (BA)	10.12.88	190	AUTOPSY 6	A	
55	TT	F	VARANO (FG)	18.01.89	242	AUTOPSY 13	A	
56	TT	M	TORRE A MARE (BA)	07.02.89	280	AUTOPSY 12	A	
57	TT	F	BRINDISI	09.02.89	190	/	A	
58	TT	/	LESINA (FG)	12.03.89	220	DESTROYED	A	
59	ODONT.	/	MARUGGIO (TA)	25.04.89	/	/	I	
60	ODONT.	/	CASTELLANETA M. (TA)	30.04.89	/	/	I	
61	ODONT.	/	S. MARIA AL BAGNO (LE)	16.05.89	200	CONGEALED	I	
62	TT	/	MOLFETTA (BA)	29.05.89	300	DESTROYED	A	*
63	SC	M	TORRE OVO (TA)	27.06.89	185	DESTROYED	I	
64	TT	F	MOLA DI BARI (BA)	16.07.89	265	DESTROYED	A	
65	ODONT.	/	OSTUNI (BR)	27.07.89	200	STOLEN	A	
66	TT	M	POLIGNANO (BA)	28.07.89	245	DESTROYED	A	*
67	TT	/	BARI	29.07.89	300	DESTROYED	A	
68	SC	/	BRINDISI	02.08.89	/	DESTROYED	A	
69	SC	/	BRINDISI	04.08.89	/	DESTROYED	A	
70	ODONT.	/	MOLA DI BARI (BA)	09.08.89	PART	DESTROYED	A	
71	SC	/	T. COLUMENA (LE)	28.08.89	160	CONGEALED	I	*
72	TT	M	BARI	08.09.89	290	DESTROYED	A	
73	TT	M	TRANI (BA)	25.09.89	157	DESTROYED	A	
74	TT	/	MOLFETTA (BA)	07.10.89	270	DESTROYED	A	
75	SC	M	TORCHIAROLO (BR)	24.10.89	200	/	A	
76	ODONT.	/	TORCHIAROLO (BR)	05.11.89	/	/	A	
77	SC	F	MARUGGIO (TA)	16.12.89	200	AUTOPSY 4/90	I	
78	TT	/	POLIGNANO (BA)	27.01.90	243	AUTOPSY 1/90	A	
79	TT	M	LESINA (FG)	04.03.90	200	AUTOPSY 3/90	A	
80	TT	M	PILONE (BR)	11.03.90	190	AUTOPSY 2/90	A	*
81	TT	/	TORRE GUACETO (BR)	19.03.90	204	DESTROYED	A	
82	SC	F	S. PIETRO IN B. (TA)	27.03.90	140	AUTOPSY 4/90	I	*
83	SC	F	M. DI LEPORANO (TA)	04.04.90	201	AUTOPSY 5/90	I	*
84	GG	/	GALLIPOLI (LE)	/	/	DESTROYED	I	
85	GG	/	GALLIPOLI (LE)	/	/	DESTROYED	I	

